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THE REPUTATION OF THE LANTERN FLY.

BY JOHN C. BRANNER.

IN nearly every part of Brazil one may hear the most incredible stories of a deadly insect, the very name of which inspires the greatest awe. When I first heard these stories of the terrible *gitiranabóia*, *tiranabóia*, etc., as it is called, I was naturally rather skeptical, but continually hearing them repeated and testified to, not only by the common people but even by men of education and standing, and seeing in print accounts of the devastation wrought by this insect, I was finally induced to inquire into its existence and character.

To give an idea of the popular opinion of the *gitiranabóia*, I need only give a few specimens of the stories that are told of it. The prevailing opinion is, that it is about the size of our seventeen-year locust or a little larger, having a long poisonous beak projecting from its large head; that it has great powers of flight, and when, in its wild career, it strikes any living object—if an animal, no matter how large or powerful—it falls dead upon the spot; if a tree it soon wilts and dies.

A certain distinguished Brazilian engineer corroborated the general truth of these stories, and assured me that along the Amazonas a monkey might sometimes be seen among the topmost branches of a lofty tree, when all of a sudden he would come tumbling down dead, without any apparent cause, struck by the fatal *gitiranabóia*. An extract from a Spanish American newspaper was shown me a couple of years ago in which this insect was spoken of as destroying the cattle of Brazil in the grazing country of the southern provinces. In Pará I was assured that

it was known to have stung a child which died a few days afterwards in great agony, and in spite of all the physicians could do.

Many such cases were mentioned to me in various parts of the empire, and although on several occasions I met persons who claimed to have seen the insect itself, I was never able to come upon an actual case of injury done by the insect, or to see any one who had seen it wound the offended party.

Search for the *gitiranabóia* itself was nigh proving futile also, but by dint of perseverance, cross-examinations, the sifting and patching together of evidence, I succeeded finally in cornering this destroyer of life in general and of the human race in particular. Some of my informants told me that it folded its long beak beneath its body when it was not angry or bent upon destruction. Here, perhaps, was one character. Others said that its head was very large in proportion to the rest of its body, in size and general form much resembling a peanut. Others again told of its being blind, though it appeared to have large eyes on the sides of its big, ugly head, while others added that this head was luminous. These characters pointed plainly to the *fulgore* or *porte-lanterne* of the French entomologists.

Before trying to clear its character I took pains to assure myself that the *Fulgora lanternaria* is the so-called *gitiranabóia*, and that it is generally supposed by the common people of Brazil to be poisonous. Just here trouble began again, for once I could show that this insect was neither luminous nor harmful, it would be stoutly declared that "in that case this was not the *true gitiranabóia*." And this is exactly what happened.[1]

Along the coast south of Bahia[2] the *gitiranabóia* is called the *bicho do pau parahy'ba*, because it frequents the tree there known as the *pau parahy'ba* (*Simaba versicolor* St. Hilaire).

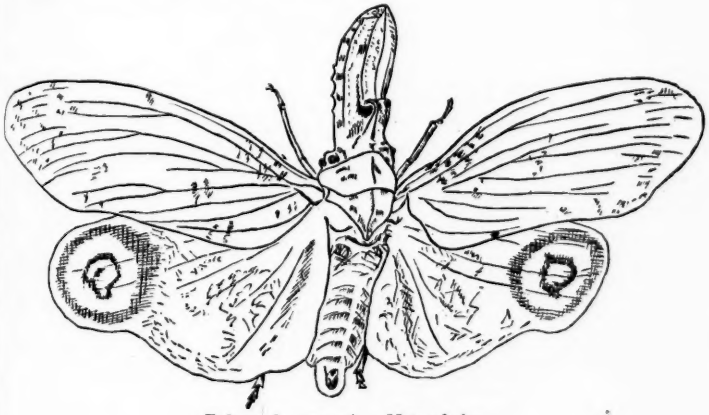
On one occasion a living specimen was taken to Bahia as a great curiosity, and exhibited on exchange, where it was looked upon and treated with the greatest respect. Dr. Antonio de Lacerda, a Brazilian gentleman who takes an active and intelligent interest in entomology, saw the specimen and heard the countryman's story of the death of a person caused by this very

[1] I had a very similar experience in Brazil with a certain snake. The reputation of the *salamandro* was, if anything, a little worse than that of the *gitiranabóia*, but when the snake was found, and I showed that its bite was not fatal, or even very painful, I was told: "Then that is not the genuine salamandro."

[2] Specimens of these insects can be had of dealers in Bahia for about 50 cents each.

insect. He laughed at the seriousness with which the story was received, refused to believe that it had injured any one, and to the horror of every one present, took the insect in his hand and repeatedly thrust his finger against the point of its beak which was said to be so deadly. I mention this case especially to show that there can be no doubt about the identity of the insect. Dr. Lacerda also showed me specimens of it in his own collection.

Another proof of its identity is given by Pompeo de Souza in his Ensaio Estatistico da Provincia do Ceará, p. 216. Among the insects of that province he mentions the *tiranabóia*, which, he says, "is supposed to be poisonous, but there is no fact to justify this story." A dried specimen was sent him from the interior, and he declares it to be a hemipter.



Fulgora lanternaria. Natural size.

It goes without saying that this *gitiranabóia* is perfectly harmless. It may be added also that its scientific name is a misnomer as far as it relates to its producing light. I was often assured that its head was luminous, but I have never met a single person who claimed to have seen this luminosity. Snr. Luiz A. A. de Carvalho, Jr., of Rio de Janeiro, who has several species of these beautiful insects in his collection, assured me that he knew of no evidence whatever that they produced light. Prince Maximilien de Wied-Neuwied says on this subject: "Nous n'avons jamais aperçu le moindre vestige de la luerer éclatante du fulgore porte-lanterne (*Fulgora lanternaria*) quoique nous avons souvent pris cet insecte sur les arbres."

Instances of extravagant stories of this kind are not uncommon in Brazil. The case of the *salamandro* already referred to is a good example. Another is that of a plant, a species of smilax, which is said to grow from the dead body of a Cicada. Belief in this story is so general that through some parts of the country a certain plant is popularly known as the *japecánga da cigarra*, or cicada smilax. Those who claimed to have actually seen this phenomenon represented that the plants seen by them were all quite young. Doubtless they were cases of larvæ killed by parasitic fungoid growth.[1]

Such stories come, of course, from imperfect observation, and have an air of truth about them derived from their association with known objects or facts.

NOTE.—We are unable to find any reference in entomological works as to the poisonous nature of this insect, which is undoubtedly perfectly harmless. It is, however, disputed whether the insect is luminous or not. See Westwood's Introduction to the Modern Classification of Insects, II, 428, where after referring to his figure of the head of *Fulgora lanternaria*, he says it "is the part of the body asserted by various writers to emit a strong light by night, analogous to that of the fireflies." The account of the luminosity of this insect originated with Madam Merian, but it was denied by Olivier, in which opinion Hoffmansegg, the Prince Von Nieuwied and Lacordaire concurred. "M. Wesmael has recently reasserted the luminous property of the South American species on the authority of a friend who had witnessed it alive. And W. Baird, Esq., has informed me of the existence of a Chinese edict against young ladies keeping lantern flies." In our Guide to the study of Insects (p. 533) is the following statement regarding the East African lantern fly: "Mr. Caleb Cooke, of Salem, who resided several years in Zanzibar, Africa, informs me that the lantern fly is said by the natives to be luminous. They state that the long snout lights up in the night, and in describing it say "its head is like a lamp" (keetchua kana-tah).—*A. S. Packard.*

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AGE OF FOREST TREES.

BY JNO. T. CAMPBELL.

THE age of trees that have an exogenous growth is correctly indicated by the concentric rings of growth shown in their cross-section. These rings also, when correctly interpreted give a true history of the tree from its infancy to maturity and old age; showing correctly the dates of prosperity and adversity in the career of the tree.

[1] Comte Charles d'Ursel, in his Sud Amérique, figures and describes, after a fashion, "l'insecte qui devient plante," found in Brazil. Speaking of the plant, he says that "au printemps elle se couvre de fleurs bleues," p. 107.

One ring is formed each year between the bark and the previously-formed wood. If there is a large healthy top of branches, these concentric rings will be relatively large, especially so if the tree is not overshadowed by older and larger ones. During the past fifteen years there have been thousands of white oak trees sawed down in this country (Western Indiana) for staves, and I have taken the time and trouble to count the ages of several hundred of them; also the ages of other forest trees; but my observations of the oaks have exceeded those of all other kinds. I was led into this investigation by reading an article in a newspaper purporting to be copied from some scientific magazine, the name of which I have forgotten, which article claimed, not only confidently but positively, that the large rings of growth indicated past wet years in Kansas, or years favorable to vegetation, and that the small rings indicated past dry years, or years unfavorable to vegetable growth. The article stated that the count from the outside ring inwardly coincided with the past seasons historically as far back as the whites or Indians had any tradition of the seasons. The article further stated that some English scientific journal had published an article by some traveler up the Nile, in Egypt, who had made the same discovery there. He had counted the rings on the oak stumps there from the outside inwardly, comparing them with the years counted backwards, and had made the startling discovery that the seven years of plenty followed by the seven years of famine during Joseph's rule in Egypt, were actually and accurately registered on the stumps. Sometimes an absurdity is so plain that nobody sees it at all. This is one of that sort. It did not then occur to me that a tree old enough to keep books in Joseph's time would, if living now, be about twenty-five feet in diameter, if it grew like an average Hoosier oak. But the story had a charm for the credulous, and it led me to estimate the age of trees here, and to compare the large and small rings with the years of plenty and the years of famine. To my surprise, and considerable disappointment, there was no coincidence whatever between them. I found stumps of trees of the same species, the same size (and presumably the same age) standing within twenty feet of each other, on the same kind of soil, cut down the same year, and, so far as I could judge, subject to the same conditions throughout, one showing a large ring where its neighbor would show only an average one, and in some few

cases they showed the opposite—one large and the other small. I examined enough to prove that whatever they might show in Kansas or in Egypt, they showed nothing of the kind in Western Indiana.

I have not been, so far, able to account for the spasmodic production of single rings of large or small growth, interspersed here and there among those of the average size. But when a succession of large, and especially small, rings prevail, say from ten to seventy-five or more, I can see a possible cause producing them, and have strong circumstantial evidence that such is the very probable cause of the large or small rings. Trees are like men in some respects. More are born than can live; more live than thrive; more thrive than can be masters.

> "The young cannot hold sway
> Till the old are dead and out of the way."

The tree that falls behind its fellows in the race of life will very likely fall behind the more active of the next generation also. Many are crowded and smothered out in infancy by their more vigorous brother infants. Nature is not generous or charitable. She knows but one law of growth: "To him that hath, shall be given; to him that hath not, the little he hath shall be taken away." When a tree gets but little the start of its immediate fellows, all the nourishment of nature seems to be offered to it, instead of its more needy neighbors. And to the weakest, nature gives next to no sympathy at all. I have seen two trees of the same species, the same age to a year, standing side by side, the one three times the diameter of the other and more than twelve times the solid contents counting increased length. Both were equally healthy, but the smaller had long ago been beaten for the nomination to leadership in convention, and had dropped back among and remained one of the mere constituents. The first rays of the morning's sun fell on the larger tree. The smaller one had to wait till eleven o'clock for sunshine, and was cut off at 2 P. M., while the larger one received it till sundown. If there was only a small shower the larger one got it. The smaller one got no rain except from heavy showers which leaked through the top of the larger one. In such a case the larger tree would have large concentric rings, while the smaller one would have them so fine they could be counted only under a magnifying glass. I have often seen just such cases.

I have been a civil engineer and land surveyor since 1867, and as such have had occasion to examine many trees referred to in the field notes. The United States surveyed the land into sections of one mile square each, and drove stakes at the section corners, and also at the quarter section corners equidistant between the section corners. They also blazed two trees near these corners about one and a half feet above the ground, cutting a small notch in the blaze, and gave in the field notes the size and species of the trees marked, and their courses and distances from the corners.

About fifty years had elapsed between the date of the survey and my day as a surveyor. Many of these trees could be identified at sight by the scar where the blaze was made. In other cases the tree would be so much larger than the size given in the field notes that the blaze would be obliterated by the spread of the bark, and the doubt would have to be settled by chopping into it at the place indicated by the notes. If we found the blaze and notch, we next counted the rings from the outside into the blaze. If the count of rings tallied with the date of the survey—all well. Mark a new tree and record it in what we call the subsequent field notes.

In the year 1868 or 1869 I was making a survey in the eastern part of the county. At a certain corner wanted, the field notes called for an ash three inches in diameter. The only ash near and answering to the locality, was about eighteen inches in diameter. Nobody expected to find so large a tree in the fifty years that had elapsed since it was marked. But on chopping into it we found the blaze and notch near the heart, revealing the unmistakable fact that it was the real "witness tree," and that it had been marked by a left-handed chopper with a dull axe. A look at the ground and timber about the corner showed the further fact that just before the original (United States) survey was made, a tornado had passed over that place and blown down all the adult trees, as all the present ones were young and thrifty, and the graves of the fallen trees were as plain as any mark could be. A tree-grave is easily known; as the tree falls the roots hold a considerable quantity of earth in their grasp, which leaves a large hole in the ground under where the tree stood. In time the body and roots will rot, leaving the dirt piled up on the side of the hole the tree fell on, and it looks as if a grave had been dug with

the dirt all cast out on one side, and the corpse had got away and the grave remained unfilled. This tree had increased six times its diameter, and more than thirty-six (and counting the increased length nearly seventy-two) times its solid contents since the government surveyors had marked it.

The next year I made a survey in the rough hills of Sugar creek in the north-east part of the county, and in identifying a land corner I had occasion to examine another ash described in the field notes as three inches in diameter also. It stood on the point of a sandstone ridge, between three large white oaks, which formed a triangle around it, and were about fifteen feet apart. This ash, the same species as the one before described, had not grown to exceed one-half inch in the increase of its diameter in the fifty or fifty-one years since it had been marked. This would allow only one-fourth of an inch on each side; yet I counted under a magnifier, in this small space, the required number of rings of growth. They were thinner than common book paper, as they were at the rate of two hundred to the inch. This tree had increased only thirty-six per cent in fifty years, while the former had increased about seven thousand per cent in the same time. Why this difference in the size of these two ash trees? The reasons are plain. The former had a good soil on level ground, and the tornado had destroyed all the adult trees that would rob it of sunshine, rain and soil nourishment. The latter stood in dissolved sandstone for soil, on the top of a narrow ridge between three large oaks, which robbed it of sunlight and rain, and nearly all the soil nourishment. It had but five or six small branches for a top, and but few leaves to the branch. Under such conditions it did well to even exist. But to do this it was obliged to add a ring each year.

Eleven years ago I examined the stumps of two white oaks and the grave of a third, which told this singular story by circumstantial evidence so strong that it could not be doubted. In the year 1502 an acorn fell about one and a half miles from where I am now writing (Rockville, Indiana), and by favorable chance sprouted and grew into an oak. In 1594 another acorn sprouted about twenty feet distant from it. It may have grown on the tree before mentioned, as it was then ninety-two years old. In 1731 a tornado from the north-west blew down a still older oak, which in its fall struck against and greatly damaged the top of the one

born in 1502. There is to-day the well-marked grave of the fallen giant, the dirt piled upon the south-east side of the hole, and a long depression in the ground where the trunk fell and rotted till not a vestige of its wood can be seen to-day (though some traces of the bark of the roots can). This depression points to the stump of the damaged oak. The two younger had been freshly cut down when I examined them. Their stumps were about four feet across, and there was not over an inch difference between their diameters, though ninety-two years difference in their ages. The younger had a large, healthy top, no broken or dead limbs, and it had put on rings of growth from the beginning of more than average size. The older one had been injured in its branches by the fall of the still older one before mentioned (in 1731) and for fifty-seven years had put on very small rings of growth (about twenty-five to thirty years to the inch instead of twelve to fifteen as it should), when a new set of branches developed to take the place of the damaged ones, and the rings began to increase in size and gradually attained to the average. I examined their tops, which coincided with what has gone before. There were the peculiar knots in the top of the older one where dead limbs had rotted off and were healed over. (Any expert timberman will readily recognize them.) During this delay the younger oak caught up with the older one in size. The size of a tree is a very uncertain indication of its age.

In all the cases of the hundreds I have examined of the oaks (the oldest trees of the forest I think), I never saw but one that was here when Columbus discovered America. That one was by far the largest I ever saw, and was over six hundred years old, about twice the age of the other largest ones. I could not get its exact age as it was so decayed near the heart I could not distinguish the rings. It was between six and seven feet in diameter, and forked about sixty feet up, and each fork was as large as the other largest trees. It was not sound enough to make good lumber, being what in this region is called "doughty," a state between soundness and rottenness. It had been down a year before I examined it (being out of the county when it was cut), so that it was very difficult to examine it. I have mislaid my memorandum of it, but it would be about as follows: At the age of about two hundred years it had some ill-fortune which caused it to form about one hundred small rings. It then regained its

health and formed normal rings for about one hundred and forty years, when another mishap caused small rings till within the last fifty years, when it was putting on fair growths again. This tree was about one and a half miles south-east of Rockville, Indiana, and was noted among hunters and woodmen. It was a disagreeable showery day when I examined it, and for that reason I did not examine its top to see if dead and lost and healed-over limbs coincided with the small rings, but I have often done so in other cases, and found them to coincide.

Last May (1884) I examined a sycamore and water elm in the Wabash river bottom, the former six feet in diameter and the latter five, each one hundred and eighty years old. They stood about one hundred and fifty feet apart. They were standing on the upper end of a newly made bottom (I mean new as compared with the higher and older bottoms a little more inland from the river, say two hundred years old). This was the largest sycamore I ever saw that was sound to the heart. I have seen hollow ones nearly eight feet in diameter. This tree seems never to have met with any mishap till the log man came along, as the rings of growth were all unusually large.

These trees very probably sprouted twelve to fifteen feet below the present surface of the bottom. They generally begin life on the lower end of river sandbars, and as sedimentation builds up the surface, they put out new surface roots at every two to three feet of elevation. Such trees with their several sets of surface roots, are often seen in drift piles, and also still standing on the verge of a steep river bank where one side is exposed by the erosion of the river. Their roots are often hollow like their trunks, the hollow (and root too) decreasing in diameter downward till it terminates in a point, like a cone standing on its point. In the south-west corner of this county is a hollow cottonwood stump on what is now a high bottom of the Wabash, in which the hollow extends downward twelve feet. Mr. Joseph J. Daniels, an intelligent, observing man, on whose land it stands, told me so. Such silting up over the surface roots would kill most of the upland trees, or those that grow from the seed on the high bottoms.

THE RELATIONS OF MIND AND MATTER.

BY CHARLES MORRIS.

(Continued from p. 767, August number.)

IV. The Instrumentality of the Brain.

WE have, in the preceding sections, reached several conclusions as to the character, development and mode of operation of the nervous organism. We have next to consider this organism in its relation to the development of the mind. This is undoubtedly the most difficult of the whole broad scope of problems to which science has addressed itself. Much has been written upon it, but we can scarcely say much that is satisfactory. It remains yet in great measure an open question, though a far narrower one than of old. Science has strongly attacked the outworks, if not the citadel of the problem, and has effectually dispersed the cloud of immaterial existences about which the thoughts of men so long hovered. It is becoming clearly evident that all existence is based upon substance. It may not be that species of substance which we call matter. For all we know there may be many species of substance. Yet there is no resting-point between something and nothing, and immateriality sinks into the category of nothingness.

But we are able to bring the conditions of the mind much nearer to the ordinary conditions of the material universe than this. The old idea that the soul is brought full fledged from some distant limbo of souls, and implanted in the infantile organism, might serve for the philosophers of a mediæval dreamland, but can hardly be sustained in this wide-awake age. To us the germ of the mental organism forms part of the physical germ, and the whole development of the mind takes place through the influences acting upon the body. It is well known that the degree of the mental development is in close accordance with the variety and quantity of these external influences. If the body be closed against their entrance, through loss of the organs of the higher senses, the mind remains undeveloped. If all the senses were shut off and no external influence permitted to reach the germ of the mind, it must continue in the germinal state. In like manner if the senses be active, but the brain, the inner organ of the mind, be inactive or abnormal in condition, the mental development is similarly checked. All this needs no argument. Every one

must admit that the development of the mind takes place through the agency of external energies transmitted by the nervous mechanism.

But these energies are entirely motor. They are either radiant vibrations emanating from some distant substance, or the motions of molecules impressed upon the body through direct contact. Each of them has its special character, but they are all motions. In their transmission inward over the nerve fibers they continue to be motor agencies. They are now some mode of radiant energy. Those that pass through the ganglia and reach the muscles, prove their motor character by disturbing the motor relations of the muscle cells. Those that are retained in the ganglia, and yield other effects, must do so as motor agencies. It is simply impossible that motion can become anything else. Nor can it exist independent of substance. Nor can it cease to exist. Every quantity of motion must of absolute necessity continue to exist as the same quantity of motion. It cannot lose or gain quantity, or change into some condition that is non-motion. Nor can it exist as an immaterial condition. It is indissolubly wedded to substance.

These conclusions can scarcely be questioned by any scientist, yet they lead to certain important inferences. If the development of the mind takes place solely through the influence of special motions, conveyed to it over the channel of the nerves, then the mind must necessarily be based in substance, and its energies must necessarily be motor. The idea that an immateriality can be organized by motor agencies is a mere metaphysical phantasm.

But though a definite quantity of motion cannot lose or gain, its action upon matter may be almost infinitely varied. It may separate and become widely diffused, or it may become definitely fixed in a certain aggregate of matter. The organization of matter takes place solely through the influences of its inherent motions. The concentration of a crystal may be due to attraction, but its peculiar characteristics are undoubtedly due to the special motions of its particles. And an Amœba is superior in organization to a crystal solely through the vastly greater complexity and intricacy of the motions which affect its particles. In all these cases of aggregation the attractive agency seems to be single and unvarying in character. Its full effect is resisted by the

motion of the constituent particles, and with every variation in the vigor or complexity of these motions some variation in the volume, form or rigidity of the mass takes place. The reduced rigidity and varied constitution of organic cells is primarily due to the great absorption of heat or motor energy in the formation of their chemical molecules, and the variety of such molecules which enters into their constitution.

This consideration of the relations of matter and motion leads to a second. Motion may affect matter in either a general or a special mode. In the former case it tends to disorganize, in the latter to organize matter. Heat motion is a disorganizing influence. It constantly tends towards the disaggregation of matter. Electricity yields results partly of disintegration, partly of integration. Magnetism is a more specialized motor agency, and its effects tend to integration. The motor energies which enter into chemical phenomena are yet more varied and specialized, and tend strictly towards material organization. Thus the disorganization and organization of matter seem alike due to motor agencies. In the case of all organization the attractive affinities of chemical particles enter as an essential element. Motion, of whatever kind, may oppose these affinities, but it is quite possible for a definite harmony to exist between these two agencies. For instance, the solar system is a definite organism, due to the harmonized relations of its motions with its gravitative attractions. The same is the case with the earth as a whole, and with every crystal upon the earth. In the case of the solar system the disrupting activity of motion is overcome by its being forced into closed curves of rotation, yielding a fixed balance of energy between the two opposing forces. Something similar may exist in all organized masses. Every mass of fixed organization, whether it be earth, crystal, organic cell or animal body is subject to the opposite influences above named, those of attraction and motion, and its fixity indicates that a definite balance exists between these influences. Motion, therefore, may be said to be organizing when, by moving in closed curves or in other special modes, it becomes in harmony with attraction, the degree of concentration of matter depending on the comparative vigor of the two opposing forces.

All this may seem to have no relation to the problem of the development of the mind. Yet it is evident that motion is the

agent directly concerned in this development, and we can conceive of but one result of the agency of motion, that of change in the space relations of matter. The motion which enters the cerebral ganglion, and is retained there, cannot cease to exist. One of two things must happen. It may flow into the surrounding matter as heat, or in some other general and dissipating condition. Or it may become an organizing agent, and enter into some substance as a permanent factor. It may produce a mental compound of substance analogous to the inorganic crystal, and like the latter unchanging in form and in its internal conditions. The disorganizing energies of nature act upon the crystal. Heat and electricity pass through it but do not disintegrate it unless they become of excessive vigor. The same may be the case with the mental organism. This much we know, that the special motor energies which enter the body and are conveyed to the cerebrum produce those conditions which we call memories, and which are permanent and unchanging. If these are motor conditions they must be motions of organization, influences which partly overcome but which fall into harmonious relations with the force of attraction and condensation. And it follows as a corollary that the development of the mental organism from its germ to its highest unfoldment takes place through a continued succession of these organizing motor influences. The intricacy of the organism steadily increases, as it is affected by motions of higher complexity, but every motor state produced is permanent. The existence of higher motor conditions does not cause obliteration of the lower ones. This is one of the marked characteristics of motion. In the circle the straight line of motion is masked, not obliterated. In the spiral the circle persists. In the spiral vortex all these inferior stages can be traced. And in the organizing motions of the mind all inferior stages persist as constituent parts of the superior stages. Consciousness may be directed to any of these motor conditions, in which case they appear as memories. But consciousness has no bearing upon their existence. They continue through life active conditions of the mind, though they may seldom or never come within the sphere of consciousness.

The preceding argument is not advanced as anything new. It is rapidly becoming a common belief with scientists that the mind has its basis in matter, and that thought is a motor affec-

tion of this matter. The belief in the material basis of mind, indeed, has become a somewhat developed idea. It has of late years grown a more and more widely accepted opinion with scientists that the brain is the organ of mind, that mental conditions are motor affections of the matter of the brain, and that they can persist only during the persistence of the brain as a functional organ, and must return into the realm of unspecialized motions on the disintegration of the brain. Before considering this question it was necessary to obtain some idea of the general principles of relation between matter and motion, and of the conditions under which alone motion could be retained in a local mass of matter in a persistent and specialized phase.

In addition to a widely entertained opinion among scientists upon this subject, several authors have made it the special theme of their works, and have brought all the conclusions of anatomical and physiological science and the principles of the correlation and conservation of force in support of their argument that the brain is the only and sufficient mental organ. Of the authors who have treated the subject from this point of view may be named Bastian and Maudsley of England, Luys of France, and Moleschott, Vogt, Büchner and Haeckel of Germany. Many other authors might be named who have dealt with it more or less directly, prominent among these being Huxley. The converse has also been taken by several authors, yet none of them can be said to have squarely met the arguments of their opponents, and the most of them have dealt with it in the old and vague metaphysical method. So far as a scientific treatment of the question goes, the brain-mind theorists seem to have the best of the argument. And yet to the present writer their arguments seem the reverse of satisfactory, and their theories to need much stronger lines of evidence before they can be made self-sustaining.

That the brain is intimately and constantly concerned in the manifestations of the mind, no one will deny. But that it is alone concerned is far from being proved. The theories proposed by the several authors are the following: Huxley declares that sensation and consciousness are in some inexplicable way caused by molecular changes in the brain. This belief is based on the facts that thought and motion seem inextricably related, that every thought is accompanied by brain waste, that heat

appears as a consequence of thought, that mental action cannot go on without a constant supply of arterial blood and must cease periodically until the brain can regain its integrity through the assimilation of nutriment, and finally that no other organ of the mind can be discovered. The latter point, however, can be left for future consideration. It will suffice here to say that if such an organ does exist, though imperceptible to the anatomist, and if the brain is its instrument of activity, the above-named cerebral phenomena would be as necessary as on the brain-mind theory.

The earliest effort to definitely deal with this question is that of Cabanis, who advanced the idea that the brain acts like a gland, and secretes thought. This idea made a decided ripple in the thinking world, though it has long since died out. Maudsley's idea is that every sensory impression upon the brain leaves behind it some modification of the nerve elements. This he considers to be the physical basis of memory. He looks on the change that takes place as a motion, which he considers analogous to the "compounds, and compounds of compounds, of vibrations in music." Other authors propound like views, and consider thought to be a persistent vibration of the nerve fibers of the brain. Luys offers the same idea in a fuller shape. He says: "I have proposed to apply the term *phosphorescence* to that curious property the nerve elements possess of remaining a longer or shorter time in the state of vibration into which they have been thrown by the arrival of external excitations; as we see phosphorescent substances illuminated by solar rays continue to shine after the source of light which has illuminated them has disappeared."

This is the present state of the brain-mind theory, as advanced by its most ardent and learned advocates. The only definite conclusion to which they can arrive is, that thought is a persistent vibration of the cerebral nerve fibers. Indeed there is no other theory open to them. The discoveries of late years hinder them from taking refuge in the powers of a brain cell of unknown organization. It has become evident that the brain cell is essentially a mass of very delicate fibrillæ which are continued through the nucleus, and in all probability are continuous with the nerve fibers. Thus we have nothing but fibers of greater or less minuteness to deal with, and it seems to follow as a necessary

consequence that if thought is nerve motion it must be some motion of elongated fibers. This motion enters the brain as a mode of vibration in these fibers, and we can conceive of its persistence in or on them in no way except as a vibration.

Yet to theorize about a persistent vibration is to theorize on the impossible, and to set aside all the results of the science of acoustics. There is no such thing in nature as a vibration persistently active in a limited region. No limited chord can vibrate unceasingly. Its vibrations must be rapidly transmitted to the surrounding material, or be converted into some other mode of motion. Otherwise the chord would have to be surrounded by a perfect vacuum, and be utterly free from friction. No such conditions exist in the brain fibrillæ. Thus a vibratory nerve current, even if transferred by induction to a closed cerebral circuit, could not possibly retain its original condition. It must make its way onward, be transferred to surrounding material, or be quickly transformed into some other mode of motion. The conditions of the mental organism require that this mode of motion shall be an organizing one, a persistent motor affection of some substance. The brain fibrillæ, which are essentially continuations of the nerve fibers, cannot constitute such a definite and self-centered organism. Neither can the cell substance surrounding these fibrillæ. It is to this granular or homogeneous protoplasm seemingly that the cerebral activity is due. The motor impulses conveyed inward by the fibers appear to instigate chemical changes in this substance precisely as they do in the muscle substance. It falls into a lower stage of integration and sets free the energies which arouse the mind to action. Thus the brain cells seem solely instruments of the mind. But for them the mind would remain dormant. They yield, under the influence of external impulses or of impulses derived from the mind itself, energies which call the mental organism into activity. But this very evident characteristic, and the constant cerebral changes which it occasions, strongly indicate that the mental organism is distinct from the cerebrum, though to all appearance very intimately connected with it.

It may seem absurd to speak of the existence of an organism thus related to the cerebrum yet not evident to our senses. Yet the more we consider the brain as the organ of mind the less does it seem adapted to the duties thus imputed to it. It has of late

been rendered almost certain, by the researches of Ferrier and others, that each region of the cerebrum has its special duties, to the performance of which it is strictly confined. Here sensation seems to center; there motor impulses arise. Into this locality flow the sensations of sight; into that locality those of taste or smell. Speech has its center here; the motion of a particular muscle there. Instead of the whole brain being concerned in every action, each limited portion seems to be immediately and strictly related to some fixed sensory or motor region. The evidences of this are as yet somewhat broad and general, yet they are steadily growing more precise and particular. Every nerve fiber proceeding from a sensory end organ or a group of muscle fibers may connect directly with a special group of brain cells, and possibly every fibril of these fibers may terminate in a single brain cell at one extremity, and in a single muscular fibril or sensory point at the other. If such were the case the brain would be closely related in condition with the outer terminations of the nerves, and the nervous system would consist of a vast series of fibers diverging outwardly to terminate in a widely separated series of sensory and muscular cells and fibrils, and converging inwardly to terminate in a closely aggregated series of nerve cells, the latter being as individual in their duties as the former, despite their much closer grouping.

This, of course, is purely hypothetical, yet the special relation of groups of brain cells to groups of sensory or muscle cells or fibers has been established by experiment, and it is not safe to limit the possible minuteness of this relation. Yet the existence of such a relation seems to stamp the brain as the instrument of an interior mental organism. In the operations of the mind there is no evidence of such a disconnected series of duties. The mind constantly impresses us as an intimate unity. Its thoughts are in continual rapport, and call up each other with instantaneous rapidity. Such a relation could not well exist between the imagined localized vibratory energies of the brain. If each locality were capable of sending its vibrations at will to any other locality, and rousing into activity the energies of distant regions, what is to hinder the complete dissemination of these energies? If such a condition existed, the fibrils of every cell in the brain must soon become affected with a vast multitude of diverse and frequently discordant pulsations. And it is impossible to imagine

how such pulsations, even if their continued local existence were possible, are to be thus restrained and confined. They are capable at intervals of flowing out upon the fibers of the motor nerves. What hinders them from immediately flowing out? By what power are they retained, so as to be let off at arbitrary and far separated intervals? And when once such vibratory energies are set free upon the motor nerves how can they still exist in the brain? Thought is persistent, yet on this theory it could only be persistent if it never produced any effect. Motion cannot be increased or diminished at will. It cannot be discharged and yet retained. It cannot become an outflowing radiation while still existing with undiminished vigor as an organizing agent.

The problem of consciousness comes into the question here. If thought be a persistent motor affection of the nerve fibrils, and if consciousness is an accompaniment of all active thought, why then are we not steadily conscious of all our thoughts? Are we to look upon consciousness as a separate traveling agency, which moves irregularly from part to part of the brain, and adds a new increment of activity to every thought with which it momentarily combines? We can in no other way explain the vagaries of consciousness on the brain-mind hypothesis.

Again, if the brain is the organ of the mind, one of two things must be true. Either every brain cell must contain a special portion of the mental energies, or, if the thought vibrations can make their way everywhere through the brain, every cell must be a miniature copy of the whole mind. The localization of the powers of the brain is an argument for the former. The close interrelation of thought seems to necessitate the latter. The dilemma of the brain-mind theorists has its two horns of difficulty, and it becomes incumbent upon them to harmonize these opposed conditions. Another difficulty connects itself with the preceding. This is, that the cerebral cells are not permanently in existence. Every action is attended by cell waste. The old cells die and new ones take their place. Or new ones arise by the process of cell division. If the cells are reservoirs of special motor forces, what becomes of these? Are they transmitted hereditarily to the new cells? This can hardly be, since the death of the old cell is often a consequence of the transmission of its special energy to motor nerves. It cannot, therefore, transmit more than its general organizing energy to new cells. The

germ cell of an animal exists as a remarkable counterpart of the general energies of its parent, and the offspring develops into a close copy of the parental physical characteristics and mental conditions. Yet the special knowledge of the parent is never transmitted to the child. Unless the latter gain special knowledge of its own, it will remain in this respect undeveloped. So one cell may transmit to its successor its organizing characteristics, but scarcely its more delicate special motor conditions.

In fact, the more we consider this hypothesis the more unsatisfactory does it appear. If the brain is to be looked upon as a material organism, a machine with thought for one of its products, we might naturally expect to find some analogy to its mode of action in other machines. It is credited with a double duty. It is a receiver and dispatcher of nervous impressions, and it has a special discriminating power as to how, when and whither it shall despatch these impressions. What is there in the brain to decide which impressions shall be retained and which transmitted? Are there special resistances in some cells of the brain which hinder the transmission of sensory impressions to the muscles? If so, how come these resistances to break down at such arbitrary periods. What principle makes some cells resisting and others non-resisting? How is it, again, after this resistance has yielded, and the motor energy flowed out to the muscles, that the thought which it represents is still found intact in the mind, and usually stronger than before? What machine is it that has its energy within itself and still possesses it after using it to set a train of wheels in motion? And finally, how do we explain the peculiar relations of consciousness to these thought impressions?

All this presents no difficulty if we can conceive of a mental organism distinct from, but in the most intimate relation with, the cerebrum, upon whose separate regions its thoughts play, like the fingers of a performer upon the separate keys of a piano. The same finger may touch many keys in succession and bring out a special tone from each. The player may be a single organism, a resultant of organizing motor energies inherent in a definite mass of substance, while the instrument may be made up of many separate parts, having only general and no intimate interrelations. The player may bring out what sound he desires, but it would not be easy for one key to emit another sound at will, or to force another key to emit its special sound. And even if the piano

key had a reservoir of energy by which, at some arbitrary period, it could suddenly spring into activity and yield a peculiar sound, evidently a part or the whole of this special force must be exhausted in doing so. But if struck by an exterior organism the latter might be strengthened by the exercise, as a muscle is strengthened by use. This is a characteristic feature of mental action. Its special energies, or its thoughts, are strengthened by use. It seems evident that such a condition can only exist in the case of a definitely centralized organism, affected by motion as an organizing agent, and also by generalized motions, which it has the power to divert in certain directions without detriment to its organization. Such is the human body. It is definitely organized by the double agency of chemical affinity and inhering motions, which limit the condensing action of affinity. In addition it is the seat of heat, electric and other motions, which it can employ as agents of external action. The mind, as an organism, displays these same characteristics. It is organized by permanent motor conditions. It receives and emits definitely directed motions. And its organization is affected and developed through this activity precisely as the organization of the body is aided and modified by the energies which it receives and emits. The parallel is a close one, and indicates that the mind, like every organism in nature, is a self-centered mass of substance, held together by affinity and organized by inherent motions.

There is nothing in the conditions of the cerebral organ to indicate that it is such a single, definite organism, or that it is capable of manifesting the peculiar phenomena of the mind. The great difficulty in the brain-mind theory is that the machine cannot contain within itself the voluntary will power of the engineer. If thoughts are the motor energies of the brain matter it is simply incredible that they could arbitrarily retire from and reënter the field of activity. The character of their activity must be fixed, constant and unvarying. And the effects they are capable of producing must be immediately or incessantly produced. It is impossible to conceive of a self-acting machine under any other relations. All its energies must be steadily in activity, and its effects on outer matter must be limited and constantly similar. We cannot imagine such a machine arbitrarily changing its action; now producing one effect, now another; now acting on

one substance, now on another; its different parts irregularly rising into activity or sinking into quiescence; and its energies continuing unchanged and inexhausted through all this varied outflow of motor activity. No instance of the kind was ever seen or can be imagined to exist. The existence of such arbitrary and seemingly voluntary activity irresistibly leads to the inference of a separate agent overruling the action of the machine, and now calling this, now that part into activity. On the theory of self-action of any instrument it is impossible to admit the existence of arbitrary and irregular variations of activity like those of the mind. On the opposite theory that the mind is an organism separate from the brain, and using the latter as its instrument, we can readily comprehend the varying action of the instrument. If the two be in close but not in constant connection; if the mind now makes contact with one group of brain cells, now with another, and now withdraws from all contact, the difficulty diminishes. Why these varying contacts takes place is a question of a different character. They may be due to influences of affinity or polarization, which are subject to change under the changes in cerebral conditions which they induce. Or they may be otherwise produced. It is difficult to understand the cause of such seemingly arbitrary contacts; but this difficulty is not an impossibility like that attending the brain-mind theory. And under the idea that the mind is a separate organism we can understand the vagaries of consciousness, which cannot possibly be done under the brain-mind hypothesis. This subject will be considered later.

There is one more consideration to which we may briefly advert. The cerebrum is subject to pathological changes. It frequently becomes incapable of doing its duty properly. In many instances of cerebral disorder the mind seems to disappear. A whole series of mental conditions may utterly vanish, and remain lost for years. A new series of mental conditions may be built up. Or every trace of intelligence and consciousness may disappear and the body act as a mere automaton, governed by reflex action only, or possibly by the deeply based hereditary or instinctive mental powers. And yet, after years of this mental obliteration, there are instances on record where the brain recovered its normal condition and the mind reappeared with all its former contents of memories, opinions and ideas. Such a cir-

cumstance it is impossible to comprehend under the theory that the thoughts are but motor affections of brain matter. In these years of disorder it is absolutely certain that considerable modifications must take place in this matter. The motions affecting its cells and fibers cannot continue absolutely the same as they were years before, but must have become greatly changed and reorganized under years of influx of external energies. But if we view the mental organism as separate from the cerebrum these strange phenomena lose much of their mysteriousness. In that case the disorder of the cerebrum may not have directly affected the mind, but simply broken the connection between the mind and its organ of manifestation and development. The mental organism may lie for years intact, as a crystal lies buried in its bed of rock. It retains its original conditions since it has been removed from the influence of disturbing energies. And when once again it regains its powers of manifestation, through the regained normal condition of the cerebrum, it must reappear in the precise condition which it had attained at the period of the broken connection, and with all its memories and ideas intact.

If we consider the relations of the nervous system from this point of view, we perceive it to be composed of a vast aggregate of fibers, which divide into their constituent fibrillæ in the ganglion cells. These fibers are in contact, at their opposite extremities, with two distinct sources of energy. One series of them runs from the brain to the sense organs on the surface. Another series runs from the brain to the muscles. The first series has its receptive extremities at the surface, and conveys the energies of external nature to the brain to discharge them into the mental organism. The second series has its receptive extremities in the brain, and conveys energies received from the mental organism to the muscles, there to discharge them. Each of these fibers apparently has its fixed and single duty. If one of the sensory nerves be touched, it carries an impression to a fixed locality in the brain. If one of the motor nerves be touched, it carries an impression to a fixed muscle. The more deeply anatomy and physiology search into the conditions of the nervous system the more clearly it appears to be simply such an instrument for the conveyance of impressions to and from two sources of energy, an external and an internal one, and the less fitted does it seem to sustain the theory that the brain is the organ of the mind.

THE EXHALATION OF OZONE BY ODOROUS PLANTS.

BY DRS. J. M. ANDERS AND G. B. M. MILLER

IN the AMERICAN NATURALIST for April and May of the year 1884, there appeared two articles, by one of us, treating of the "Exhalation of Ozone by Flowering Plants." The reader will there find recorded the results of numerous experiments which were made with the view of ascertaining whether or not plants have the power to generate ozone. The chief conclusions therefrom deduced were as follows: 1. That flowering plants in general are capable of generating ozone, and odoriferous flowers in particular. 2. That foliage plants do not possess this function.

It should be remarked that the present re-investigation of the subject was undertaken with the view either of confirming or disproving the correctness of the above conclusions. Owing to the high importance of the question of the relation of plant growth to the generation of ozone, this course was deemed almost incumbent.

As the more important properties of ozone were discussed in the previous papers, it is not deemed necessary to do so here. The hygienic relations of this substance also received brief attention while its tests received careful consideration; hence to further enlarge upon these phases of our subject, at present writing, would be a work of supererogation. The methods employed in the former experiments were likewise used in the present series. The following apparatus was used: A glass case large enough to contain a dozen or more thrifty growing plants in pots. Its dimensions were, length three and a half feet, width two and a half feet, and height two and a half feet. A portion of the top was left removable, so as to furnish an aperture through which the plants could be placed in the case and again taken out. The tests employed were the Schoenbein paper and paper impregnated with tincture of guaiacum. When exposed to ozone artificially prepared the Schoenbein paper turns quite blue, while the guaiacum paper first turns greenish-blue and finally a bright blue. In the present experiments we also employed the same terminology, viz., "marked," "slight" and "very slight," to denote the degree of blue coloration.

A dozen thrifty plants belonging to the species *Coleus blumei*,

not blooming, were first selected and placed within the glass case. The test papers were moistened and suspended on the branches of the plants. After adjusting the removable part of our case, the latter was found to be pretty well filled though not overstocked with plants. For the purpose of detecting any alkaline substance whose presence, it is said, will change the Schoenbein and guaiacum papers in a manner indistinguishable from that produced by ozone, we suspended with the test papers a piece of red litmus, with the results indicated in the following tables. The air on the exterior of the case was simultaneously tested for ozone. In view of the fact that these tests are in an unsatisfactory state, the necessity for taking precautions against interfering conditions must be obvious to the mind of the scientfic reader.

The following table will serve to show the results obtained from the specimens above named for seven consecutive days in the month of June, 1884:

No. experiment.	*Schoenbein.*	*Guaiacum.*	*Schoenbein in open air.*	*Time.*	*State of weather.*	*Litmus (red).*
No. I.....	negative	negative	negative	8 hours	clear	negative
No. II.....	"	"	———	8 "	"	"
No. III.....	slight	marked	marked	11 "	"	blue
No. IV.....	negative	slight	negative	9 "	"	negative
No. V.....	"	very slight	marked	9 "	"	"
No. VI.....	"	"	negative	10 "	"	"
No. VII.....	slight	marked	slight	8 "	"	blue

These results are in exact accord with those previously recorded (supra) by one of us. It should be remarked that whilst two "slight" reactions occurred with the Schoenbein paper, they were probably due to the presence of some alkaline substance, since on the same days the red litmus was changed to a "marked" blue. Thus, after repeated experiments, it would appear certain that it cannot be claimed for non-odorous foliage plants that they are ozone-generating. Though the guaiacum paper gave "slight" reactions in three experiments which yielded no results with the litmus paper, it should be here noted that owing to the fact that this paper (guaiacum) is materially affected by various atmospheric conditions, we did not much rely upon the results obtained from its employ. On the other hand, if proper precautionary measures be taken, the Schoenbein is, doubtless, of all the tests for ozone the most reliable.

We next experimented with odorless flowering plants, selecting ten plants of the species *Fuchsia globosa* and ten periwinkles, species *Vinca rosea*, with the following results:

No. experiment.	*Schoenbein.*	*Guaiacum.*	*Schoenbein in open air.*	*Litmus (red).*	*Time.*	*State of weather.*
No. I.....	marked	marked	negative	negative	10 hours	clear
No. II.....	negative	"	marked	"	9 "	"
No. III.....	"	negative	negative	"	10 "	"
No. IV.....	very slight	slight	slight	"	13 "	"
No. V.....	"	negative	"	"	9 "	"
No. VI.....	"	slight	marked	"	9 "	"
No. VII.....	negative	"	"	"	10 "	"

During these observations, which were made in the month of July, 1884, the temperature within the case ranged from 80 to 100° Fahr. It will be observed that sufficient ozone was generated in four of the experiments to give one "marked" and three "very slight" reactions; also that the litmus gave no indications of the presence of ammonia. Although they do not rank as active ozone-generators, nevertheless they must, from the facts of the case, be looked upon as sharing this important function in a slight degree. This decision also coincides with what had been previously demonstrated by experiment.

We now made a trial of odorous flowering plants, selecting for this purpose seven roses and seven specimens of *Lilium longiflorum*. After carefully enclosing them within the case, the atmosphere of the latter was tested and simultaneously the air outside, with striking results as shown by the following table:

No. experiment.	*Schoenbein.*	*Guaiacum.*	*Schoenbein in open air.*	*Litmus (red).*	*Time.*	*State of weather.*
No. I.....	negative	marked	negative	blue	8 hours	clear
No. II.....	marked	"	"	negative	9 "	"
No. III.....	negative	negative	"	"	9 "	pa'ly clou'y
No. IV.....	slight	marked	marked	"	8 "	clear
No. V.....	marked	"	slight	"	10 "	"
No. VI.....	"	"	very slight	"	10 "	"
No. VII.....	"	"	"	"	11 "	"
No. VIII.....	"	"	negative	"	10½"	"

During these experiments the temperature of the air in the case ranged from 80 to 100° Fahr. The important conclusion arrived at in previous papers,[1] viz., that odorous flowering plants are active and energetic ozone-producers, it will be clear, receives from present researches entire confirmation. Since this

[1] Dr. Anders on "Exhalation of Ozone by Flowering Plants," *loc. cit.*, p. 474.

function is so actively carried on by odorous flowers, it occurred to us to make a trial of plants whose leaves emit odors but having no flowers. Blooming geraniums having been experimented with while making previous researches into the same subject, and having found them to be capable of generating ozone, it was determined to employ a number of specimens belonging to the genus Pelargonium not in bloom, with a view of ascertaining whether the reactions obtained with flowering geraniums were due to the presence of the flowers, or whether they were due in part to the odorous principles emitted from the leaves of the plants. To our astonishment slight reactions were obtained, as shown by the following record of results:

No. experiment.	*Schoenbein.*	*Guaiacum.*	*Schoenbein in open air.*	*Litmus (red).*	*Time.*	*State of weather.*
No. I.....	very slight	slight	marked	negative	10 hours	clear
No. II.....	negative	negative	"	"	10 "	"
No. III.....	"	"	"	"	10 "	"
No. IV	"	"	negative	"	10 "	rainy
No. V.....	very slight	very slight	"	"	10 "	clear
No. VI	negative	slight	"	"	9 "	"
No. VII.....	very slight	"	marked	"	9 "	pa'ly clou'y
No. VIII.....	negative	negative	negative	"	10 "	rainy
No. IX	"	marked	marked	"	11 "	clear
No. X.....	marked	slight	slight	"	10 "	"
No. XI	slight	"	negative	"	9 "	cloudy
No. XII.....	negative	negative	"	"	10 "	rainy

Although there were but three "very slight" reactions, one "slight" and one "marked" with the Schoenbein obtained in the twelve experiments here recorded; this is not a bad showing when it is recollected that four of the tests giving no indication of ozone were made on rainy days, it having been shown in the former investigations that sunlight or at least good diffused light is an essential condition to the generation of ozone by plants.

Upon this point, however, the evidence afforded by the results of the present set of experiments alone is too slender on which to base positive conclusions, and hence we deemed it desirable to make further observations upon foliage possessed with marked perfume. To aid in clearing up this subject it was next resolved to make tests with pine foliage, possessing the well-known terebinthinate odor, and in the results obtained we were not disappointed.

Seven branches taken from the species *Pinus strobus* were introduced into the case in the upright position, when the same

tests were applied as in the experiments on growing plants, with results as follows:

No. experiment.	*Schoenbein.*	*Guaiacum.*	*Schoenbein in open air.*	*Litmus (red).*	*Time.*	*State of weather.*
No. I.....	marked	slight	very slight	negative	9 hours	clear
No. II.....	"	marked	slight	"	10 "	"
No. III.....	"	"	"	"	9 "	"
No. IV.....	slight	slight	marked	"	10 "	"
No. V.....	negative	negative	"	"	9 "	"

After three days the pine branches turned brown and the leaves rapidly dropped off. These facts doubtless account for negative results after the fourth day. It should be stated that we continued to test them on the sixth and seventh days respectively, and with negative results in both of the latter instances. We were, however, encouraged by the success attending the first three experiments, and resolved to make another trial of pine branches. Accordingly we again selected a half dozen pine branches which moderately filled our little floral chamber, and allowed them to remain only until they began to show a change in color, which change was first observed at the end of the third experiment.

The following results speak for themselves:

No. experiment.	*Schoenbein.*	*Guaiacum.*	*Schoenbein in open air.*	*Litmus (red).*	*Time.*	*State of weather.*
No. I.....	marked	marked	marked	negative	9 hours	clear
No. II.....	"	slight	negative	"	10 "	clear, partly cloudy
No. III.....	"	"	slight	"	10 "	clear

We also made four daily experiments with branches taken from the Norway spruce (*Abies canadensis*) and, as shown by the following record, with happy results:

No. experiment.	*Schoenbein.*	*Guaiacum.*	*Schoenbein in open air.*	*Litmus (red).*	*Time.*	*State of weather.*
No. I.....	marked	marked	slight	negative	12 hours	clear
No. II.....	"	slight	negative	"	10 "	"
No. III.....	slight	marked	"	"	10 "	"
No. IV.....	marked	slight	marked	"	9 "	"

We, unfortunately, were unable at that time to obtain more foliage of the same character, and thus our investigations were brought to an end. Although a greater number of experiments upon this point could have been desired, when, on the one hand, it is recollected how great and numerous the difficulties connected

with the making of such tests, and on the other, the brilliant and very uniform success of the experiments made with pine foliage, it will be readily conceded that these facts furnish abundant evidence of the power the odorous principles evolved from the pine tree have to generate ozone.

From the foregoing, in conjunction with former investigations into the same subject, we are, at present writing, justified in formulating the following conclusions:

First. That flowering plants, including odorous and inodorous, generate ozone, the former, however, much more actively than the latter.

Secondly. That so far as tested scented foliage does possess the power to produce ozone, and in the case of pine or hemlock foliage in a marked degree.

Thirdly. That inasmuch as no reactions occurred on rainy days, it is highly probable that the function demands the influence of the sun's rays or at least good diffused light.

In comparing the present with former conclusions, cited at the commencement of the paper, it will be seen that they differ in so far as relates to foliage plants only, those pertaining to flowering vegetation being perfectly concordant.

As to the mode in which the ozone is developed by plant life, or in other words, as to what is the nature of this ozone-generating function, the following explanation was elsewhere merely suggested (loc cit.): "It is known that the ashes of seeds contains large quantities of the phosphates. It follows that during the formation of the seed there is a rapid metastasis of the phosphorus in the form of phosphoric acid, and the phosphates to that organ of the plant, and it may reasonably be supposed that in the chemico-vital interchanges going on in the ovules, phosphorus is liberated and acted on by the moisture which the leaves are so actively transpiring. * * * The subject, however, merits further investigation." In view of the facts established by present researches the theory of the production of ozone by vegetable growth above cited must be abandoned, and it appears evident, from present premises, that in some way the odoriferous principles emitted, whether from flower or foliage, are chiefly concerned in its formation. It is true we are unable in this manner to account for its production by odorless flowers, unless, as many contend, we grant that all blossoms are either

bedecked with or, somewhere in their loose cellular tissue, contain scented nectar which in many so-called inodorous flowers may not be sufficiently pronounced to be perceived by the organ of smell.

It is a well-established fact that wherever fertilization is accomplished by insects, so-called *nectaries* are somewhere found in the flowers. These organs are described by Sachs as follows: "The nectaries are often nothing but glandular portions of tissue on the foliar or axial parts of the flower; very often they project in the form of cushions of more delicate tissue or take the form of stalked or sessile protuberances; or whole foliar structures of the perianth, of the androcium or even of the gynœcium, are transformed into peculiar structures for the secretion and accumulation of the nectar."[1]

The proportion of plants where pollination is effected by insects is certainly large, and when we take into account those flowers in which cross-fertilization occasionally results from the aid of insects, this proportion is still very much larger. Whether it can be claimed for all inodorous flowers that they contain a greater or lesser number of nectaries we are not prepared to state, but it is certain that numerous flowers, which are classed as being without fragrance or any other odors, such as the geranium, the passion flower, etc., are visited by insects, and these must therefore contain glandular tissues filled with an alluring secretion. The question also naturally here arises: Are there not flowers that are never visited by insects, which flowers possess these glandular organs?

Our investigations did not include an examination of these organs, but there is evidently an interesting subject here presented for further experimental study.

The theory that the fragrant emanations from flowers, as well as all the various odoriferous substances emitted from plants, stand in close relation to the ozone-producing function in plants likewise receives striking corroboration in the well-known chemical fact that the volatile perfumes and the strongly-scented aromatic substances have the power to convert the oxygen of the atmosphere into ozone.

The application of the results of our experiments to the rather old but highly interesting subject of the cultivation of house plants

[1] Sachs' Text-book of Botany, p. 500.

is of considerable importance. That phase of the question, however, pertaining to flowering plants has been elsewhere treated. It remains to speak of the sanitary relations of the new and additional fact which has been established by the present experiments concerning odorous leaves as ozone-generators. Owing to the fact that few varieties which have markedly odorous leaves are cultivated within doors, their sanitary bearings may be regarded as being slight, the leaves of the geranium and other species usually seen in dwellings being feeble in their ozone-generating properties. Again, it should be remarked that when kept indoors the odors given off both from the flower and foliage are sometimes not only objectionable to the senses, but also may prove detrimental. It is evident that such plants should be discarded.

The case is widely different when we apply the results of our labors to the question of the hygienic value of out-door vegetation, and more particularly of pine groves. Under these circumstances unpleasant odors do not form a positive objection, whilst the species emitting the most pronounced odors are capable of rendering valuable hygienic service by furnishing ozone to the surrounding medium. Since the exhalations from the pine foliage are active agents in generating ozone, it follows that all of the important hygienic advantages of ozone are to be derived, to a marked degree, from the presence of pine woods.[1]

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GLACIAL ORIGIN OF PRESQUE ISLE, LAKE ERIE.

BY T. DWIGHT INGERSOLL.

THE peninsula of Presque isle is an extension of the main land opposite the city of Erie, Pennsylvania, reaching out into Lake Erie in a north-eastern direction. It is crescentic in form, the convex portion facing the lake with the shore line bending toward the mainland, and forming Erie harbor, which is known also as Presque Isle bay. The bay is about four miles in length by about two in breadth, with an entrance on the east. Government operations have made the bay somewhat historical. The vessels of Commodore Perry's fleet were built here in 1813,

[1]For a fuller discussion of the subject of the sanitary relations of pine forests, see article by J. M. Anders, on "Sanitary Influence of Forest Growth," a paper read before Phila. Go. Med. Society, Oct. 22, 1884.

and after his victorious battle the *Lawrence* and flag-ship *Niagara* lay in the bay until the centennial year, 1876, in front of the old block-house on Garrison hill, where General Anthony Wayne died and was buried in 1796.

When the peninsula was first occupied by Government soldiers it was several feet broad at the junction with the mainland and covered with large forest trees, but the constant action of waves, since that time, has reduced that portion to a narrow neck of land over which the waves have, during the past year, rolled into Presque Isle bay. There is a strong probability that before the expiration of the year this tract of land will be transformed into a traveling island en route to Niagara falls, unless something is done to protect it from lake storms. For a consideration of this matter there was a meeting of the Erie Board of Trade on January 5, 1885, at which Ex-judge John P. Vincent said:

"Since I came to Erie, in 1839, the north arm of the peninsula has moved several rods, and the east end extends fully a mile further than it did then. If something be not done the peninsula will waste away at the head and build up at the foot, and eventually the harbor will be below the city."

Engineers, however, have estimated the increase of land at the lower end to average only thirteen feet per annum. All this material—sand and pebbles—has been washed from the north shore, principally from that portion near the head, and when it reached the foot an eddy was formed around it, the sand falling to the bottom and becoming new-made land. Sometimes this material was carried past the peninsula too far for a union with the foot, and a bar and perhaps an island was formed, against which other sands lodged. At some subsequent time we may suppose that the eastern portion of the new formation was broken up by opposing easterly gales, and the sand carried along both sides of the new island toward the west until a union was formed with the peninsula, shutting in between the two connecting bars of sand a pond of water, and the island thereby became the foot of the peninsula, receiving further increase. In this way it is supposed that several fish-ponds, now in existence on the peninsula, have been formed.

From the briefly sketched history of Presque isle the reader may naturally be led to inquire into its origin. The writer at one time imagined that there might have been a small uplift of rocks under the surface such as he had seen on the mainland in the

vicinity; but after a personal investigation and inquiry of civil engineers, he came to the conclusion that the land is composed entirely of sand, clay and rolled pebbles of foreign and native rocks.

History shows that this material has not only been changeable in form, but small quantities have from time to time been transported from the western to the eastern portion by the waves. These changes must have been in progress prior to its discovery, and of course the peninsula was situated further west than it is now. This we may regard as a clue to the origin of the peninsula however hypothetical it may seem to be. The material being almost identical with glacial drift that is scattered all over Northwestern Pennsylvania, which in some places is nearly 200 feet in depth, and may have had the same origin, having been deposited at the same time about twenty miles west of its present site, where the Devonian strata dip gently under the surface of the lake. At that point a vast quantity of glacial drift was shoved upon the sloping rocks during the ice age, and that deposit has been the sport of the waves ever since the retreat of the great northern glacier. Professor I. C. White, of the Pennsylvania State Geological Survey, says:

"The varied character of the northern drift deposits can be well studied along the shore of Lake Erie, towards the Ohio State line, where they constitute a terrace bluff from fifty to eighty feet high, out of which the waves are constantly removing the clay and fine sand into the lake leaving the coarse sand, pebbles and boulders to be daily rounded and polished on the beach."

At the close of the ice age the waves began to wash away the finer particles from the bluff of drift, and as the current of the water was down the lake in a north-eastern direction—the storms moving generally the same way—the probability is that a bar of sand was formed at some favorable place east of the starting point, upon which other material was driven year after year until an island or peninsula was formed. At some later period more powerful storms broke up the western portion and carried it along to or beyond the eastern extremity, while it was being constantly enlarged by sand from the original source, and from the bluffs and watershed along the shore, which was brought down by numerous streams. In this way let us imagine the bar became an island or a peninsula, and alternating perhaps with each other until the erratic bodies of land appeared to the first white settlers of this region in form of a peninsula.

ERIE, PA., AUGUST, 1885.

RECENT LITERATURE.

PRINCE ROLAND BONAPARTE'S LES HABITANTS DE SURINAME.[1] —The contents of this luxurious and costly volume will prove highly interesting not to the ethnologist only, for it far exceeds the scope of his special line of research, but to the general public as well. The types of humanity which were exposed to public view at the Amsterdam Colonial Exhibition portrayed so faithfully a portion of the Dutch Guiana population that a partial study of these was rendered feasible in spite of the enormous distance separating them from their native country. The mode of anthropologic investigation followed by the Prince is sketched by him in concise language in the preface, and his methods for gaining an insight into the habits, customs, institutions and languages of a people are detailed at length. He divides that country into three dissimilar geographic belts: the coast marsh, the savanna and the primeval forest of the interior. The history of Guiana colonization is first passed in review; the main part of the volume then opens with a sketch of the Indian population, with another of the sylvan Negro, and another of the sedentary Negro, the whole profusely illustrated by full-face and profile photo-engravings of the human subjects exhibited at Amsterdam. Colored plates illustrating various manufactures and divers objects of interest for the study of these populations are added. The book divides *the Indians* into three sections: the Kalina or Carib, the Warrau and the 'Arowak. Though in contact with Europeans for longer than a century, they have retained many of their aboriginal characteristics. No Indian of the *wild* interior tribes had been brought to the Amsterdam exhibition, and hence these were omitted from the description in detail. The coast Indians do not count over 800 individuals now; they assimilate with difficulty and tend to disappear under the funest influence of firewater and disease. The chapter following this deals with customs, habits and beliefs of the Indians, and entirely rests on personal or otherwise trustworthy information. The singular custom of the couvade or male childbed is alluded to at length and an explanation offered. Heretofore our information upon the large class of runaway slaves ("nègres marrons"), or descendants of such, was very limited, but here new points are presented in logical order and profusion. These escaped "Negroes of the bush" who, for more than a century back in time, settled along the large rivers descending from the interior, and exulting in their newly-gained freedom, often made raids upon the plantations, are first alluded to in the pages of the "Lettres Edifiantes." It appears that there are now about 8000 of them, divided locally

[1] *Les Habitants de Suriname. Notes recuillies à l'Exposition coloniale d'Amsterdam en 1883.* Paris, imprimiere de Quentin, 1884. Gr. fol. 227 pp., 2 cartes et 72 planches.

into Aucaners, Bekoes, Moesingas, Saramacanan and Bonis. Their peculiar beliefs and customs, upon which the Prince's volume expatiates at length, are clearly of African origin and extremely curious. Besides the *takitaki* or Negro-English jargon of Suriname (from "*talkie-talkie*"), each local sept uses special terms of African origin, and the majority also converse in the native African tongue. The *sedentary Negroes* subdivide into plantation Negroes and city Negroes, these latter forming forty-seven per cent of the whole colonial population. Specimens of the takitaki jargon are appended.

A sequel to this instructive volume is announced by the author himself, and we wish it may be presented to the studious public at an early day.—*A. Pinart.*

BERGEN'S DEVELOPMENT THEORY.[1]—This little book is designed to present to the ordinary reader a brief summary of the evolution theory. The task is fairly well done, as the facts and theory are set forth in an attractive way, and from a varied and wide point of view.

It is just the sort of book one would give to a boy or girl, a farmer or mechanic who wanted to know what evolution means, and perhaps older people and those who have graduated from our colleges a generation ago before the doctrine became a part of ordinary scientific teaching, will find in its pages just the sort of information they want.

The facts are correctly stated, and so are the inferences. We think, however, known facts do not support the enormous antiquity ascribed to man, viz., "over two and a half million years." We think these figures are beyond those of the "best authorities." It is better in books intended for popular use to give under rather than over statements. Also the ape-like characters of the Neanderthal skull are perhaps over stated. As we understand it, Wyman found quite as brutish a skull in the Indian mounds of Florida. The evidence has yet to be afforded that the earliest known race of man in Europe was any lower than the lowest existing savages. Such evidence, may however, be forthcoming any day.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

ASIA.—*The Badghis district.*—This district in Northern Afghanistan, north of the watershed of the Herat valley, consists of hills and valleys of sandstone clay, the hills rising from 200 to 600 feet, or even to 1000 feet, between two great streams. Though sand-covered and desert-looking in autumn, they are not only cultivable on their lesser slopes but exceedingly fertile, and in spring are covered with flowers and grass knee-deep. The northern and western parts have little running water, but the eastern and southern portions, along the Parapomisus and the Kushk rivers, are exceptionally fertile. Sir Hy. Rawlinson states that the Bundehesh, a work compiled before the Arab conquest (in the fourth or fifth century) derives "Badghis" from the tribe of the Vad-Keshan or "wind-worshipers." Coins of the Kushan or Tokhari show that these tribes did worship the wind. They were commonly called "White Huns," came into the land in the fourth or fifth century, and had for their capital, Talikan, thirty or forty miles east of Maruchak. Badghis (Kileh-Maur) was their strong place.

The Pescadores—The Pescadores, recently bombarded and occupied by Admiral Courbet, are in the Formosa channel, about twenty-five miles from Formosa. The largest is Panghu, and the Chinese name for the group is Panghuting or the Panghu district. Panghu is forty-eight miles in circumference, and the next in size, Fisher's or West island, is seventeen. The population of the two larger islands was given by Admiral Collinson, in 1845, as 5000, that of all the islands, 8000. There are twenty-one inhabited islands besides several rocks. Trees are

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

wanting, millet and the ground-nut are grown, and in the sheltered spots the sweet potato, but the natives depend mainly on Formosa for vegetables and fruits. The islands offer shelter in all states of the weather in the dangerous Formosa channel.

Port Hamilton.—Port Hamilton was stated, by *Nature*, to be identical with the large Corean island of Quelpart, about sixty miles due south of the extreme point of Corea. It is 150 miles from Shanghai and 100 from Nagasaki, and lies in the mouth of the only exit to the south from the Sea of Japan. It is an oval rock-bound island covered with innumerable conical mountains, often topped by abrupt volcanic craters, the highest of which, Haura, or Mt. Auckland, is 6500 feet high, and bears at its summit three craters, within each of which is a lake of pure water. Corean children are taught to believe that the three first-created men still dwell in these lofty heights. The island is well cultivated, and contains three walled cities and several towns, but has no good harbors. It has long been a place of banishment for criminals. The chief manufacture is that of straw hats, which are the best in Corea. Iron appears to abound on the southern coast.

Nature and other English papers were, however, mistaken in the statement that the large island of Quelpart is identical with Port Hamilton, which is marked upon German maps as situated somewhat to the north of Quelpart, and is formed by three rocky and elevated islets.

Asiatic Notes.—The name Pamir applies generally to the whole region lying at the sources of the Amu-daria. The word is derived from *bam*, roof, and perhaps the Kirghiz *ir*, earth. It extends in the shape of a horse-shoe from north to south 200 miles, and from east to west 170 miles. This area of 67,000 square versts has been surveyed on a scale of five versts to the inch. On the north and south its limits are well marked by the Alai and Hindu-Kush ranges respectively, while its eastern boundary is clearly defined by the Kashgarian mountains.——The Proceedings of the Royal Geographical Society admit the error in the identification of Port Hamilton with Quelpart. Port Hamilton is thirty-eight miles N. N. E. of Quelpart, and is sheltered by three islands, the largest of which, Sodo, is three and a half miles long and 650 feet high at its highest spot. Sanhodo is about half as large and 783 feet high.——Peng Yang, the second most important city in Corea, is more a commercial than a manufacturing center, and is the capital of the province of Puing-an-do. It is more than 200 miles from Sŏul. Song-to, three days march from Sŏul, has walls as large as those of the capital, but the town has so dwindled that there is much cultivated land inside.——The Kara-kum, according to M. Lessar, is the region bounded by the Ust Urt, Khiva, Bokhara, Afghan

Turkistan, Attok and Akhal. Though the name signifies a sand desert it is not sandy throughout. The sands are of three kinds. The first is clayey, mixed with sand and covered with small hillocks and brushwood; the second kind consists of real sands which do not drift to any great extent, the drifting portion forming ridges or hillocks; but the third kind, the true *barkhans* or shifting-sand deserts, are without so much as a visible grass blade. Beside these different kinds of sands there are, in the Kara-kum, *kyrs* or tracts of firm clayey surfaces (mixed with sand) consisting of valleys alternating with eminences 140 to 210 feet high; *takirs*, or flat clayey areas surrounded by sands; and *shors* or tracts of hard ferruginous sand lying in the lowest parts of the desert.——The *Izvestia* gives an account of M. Potanin's journey from Peking to Lang-tcheou, in 1884. The country between the Yellow river and Boro-balgasun is covered with sand, rarely moving sand, but *barkhans* fortified by a growth of *shiabyk*, a species of Artemisia, with bushes of Cavagana in the cavities between. Water is plentiful. The dry grounds between the sands are covered with steppe vegetation, and sarrazin, millet and hemp are grown there. The Ordos inhabit this region. Boro-balgasun was once a town but now contains but a few huts within its ruined walls. At Edjin-khoro, on the Tchambkhak river, are two tents in which the bones of Zenghis Khan are said to be preserved. After leaving Boro-balgasun, the expedition visited the salt lake Baga-shikyr, and passed over an almost uninhabited region with ruins of Mussulman villages destroyed when the last insurrection was put down. Lin-tcheou, on the Hoang-ho, is surrounded by fruit gardens, and for fifty miles south of it numerous villages extend along a canal which runs parallel to the Hoang-ho. This richness is of recent origin, for the whole region bears traces of the desolation wrought by the Chinese after the suppression of the insurrection, of which the town of Tsin-tsi-pou was the center. South of this town M. Potanin left the Hoang-ho and crossed the series of flat ridges which rise from 6000 to 7000 feet above the sea, and are covered with loess to a thickness of 200 to 300 feet. The sandstone of these hills contains some beds of salt. The loess covers the whole country from Ping-yang-sia to Lang-tcheou, which is a great city, picturesquely built on the right bank of the Hoang-ho at the foot of a mountain. The population is of Turk origin, and though it has assumed Chinese customs, it keeps its Mussulman religion.

AFRICA.—The route from Benguela to the mission village of Bihé has been approximately surveyed by the Rev. William E. Fay. The sketch maps, contributed to the *Missionary Herald*, cover an area sixty miles wide, extending over four degrees of longitude. The first human habitations met with are at the eastern foot of the coast range. About 100 miles from the coast the Ballombo river is spanned in wet seasons by a native

bridge, whose builders take toll. The mission village lies in about 16° E. long., and 12° 15′ S. lat., in a broad and beautiful valley, densely populated, and lying east of a region of mountains estimated to have peaks from five to eight thousand feet high. ——The death of King Mtesa is confirmed, but it is believed that his son will prove more friendly to civilization than the father. Mirambo is also dead.——The Royal Geographical Society has decided to send out another expedition under Mr. J. T. Last, who will proceed to the confluence of the Rovuma and Lujendi rivers, fix the longitude of the junction, and will then establish himself awhile at the Namuli hills. After a study of this region, Mr. Last will enter the valley of the Likugu, follow it to the coast, and then follow the coast to Quillimane or Angoche.——The Portuguese possess a tract of land on the northern bank of the Congo, extending from Cape Lembo, south of Kabinda bay, to Massabé, and extending inland thirty or forty miles so as to contain Kabinda, Molembo, Landana and Massabé. The whole of the valley of the Kwilu, where the International Association had eighteen stations, is ceded to France.——Parts of the countries of Useguha, Nguru, Usagara and Ukami have, by treaty with "ten independent sultans," been brought under the protection of Germany. The commercial importance of this district is great, since the central trade route to Lake Tanganyika passes through it. After fifty to eighty miles of unhealthy coast region is passed, mountains and plains with much fertile country and sufficient water are reached. The Wa-ngaru, Wa-sagara and Wa-seguha speak nearly the same dialect. The King of the Belgians has resolved to abandon Karema and other stations of the association east of Lake Tanganyika.—— The territory now claimed by Germany in East Africa is usually supposed to recognize the authority of the Sultan of Zanzibar. The rule of this potentate is acknowleged along trade routes for at least 700 miles in the interior, and also by many chiefs away from these routes. The sultan owns 1050 miles of coast besides islands.——In spite of the succession of misfortunes which beset M. Giraud, he has added greatly to our knowledge of Lake Bangweolo. The Luapula leaves the southwest corner of the lake, as shown on Mr. Ravenstein's map.—— Capt. G. A. Chaddock has ascended the Limpopo for a considerable distance. The channel at the bar is narrow, with no less than four and a half fathoms of water. A long sandspit, three miles from the coast, forms a natural breakwater, and the water at the opening is fresh. The river channel is narrow and deep, the surrounding country low and level, and thickly populated. The lower course has no trees save some mangoes at the mouth. Captain Chaddock believes that the Limpopo is free from falls or any obstruction as far as the Transvaal.

AMERICA.—M. Chaffanjon, during an investigation of the hy-

drography of the Orinoco, not only obtained materials for a geological map of the region, but in five different places discovered inscriptions and pictures in granite, made by the natives. These he has carefully copied.—— A party commanded by Feilberg, and sent out by the Argentine Confederation to explore the Pilcomayo, found that a trade route via that river to Bolivia is not feasible. Below the rapids, sixty leagues above the mouth, the Pilcomayo receives an affluent not marked on any chart, but with as much water as the Pilcomayo or perhaps even more. It was obstructed by sunken trees. The country along these rivers is rich with fine pasturage.——From Dr. Bell's report of the geological work of the Hudson Bay expedition, it appears that the highest land of the Labrador peninsula is everywhere close to the coast, with a gradual slope westward to the basins of the Koksoak and the rivers emptying into Hudson bay. The formation throughout Northern Labrador and the strait is gneiss, mostly Huronian, but some of it Laurentian.—— Punta Arenas, the Chilian settlement in Magellan strait, is a town of 4000 inhabitants, surrounded by splendid lands with abundant pastures, forests and waters. A hill protects the town from the cold winds. The climate is said to be excellent.

Geographical News.—The fifth and sixth issues of Petermann's Mittheilungen for this year contain an account of Caffraria and the eastern districts of Cape Colony, by H. C. Schunke, with a map (in No. 5) upon a scale of 1 : 750,000. No 5 contains also some remarks upon the health-relations of the region of the Upper Amu Darja, by A. Regel; and an account of the German Geographical Congress held at Hamburg on April 9 to 11, 1885. On this occasion Doctors Steiner and Claus gave an account of their journey down the Xingu, and Dr. Boas a sketch of the Eskimo of Baffin's bay. No. 6 contains a map of the Panama canal on a scale of 1 : 120,000; an account of the German settlements on the Slave coast, by P. Langhans, and a history of ten journeys in Costa Rica, undertaken by the now expelled bishop, Dr. Theil. The coast line of the German possessions on the Slave coast is short, extending only from 1° 15′ W. to 1° 34′ W. Lome, Bugida and Porto Seguro are situated upon the shore, behind which is a lagoon, the Togo sea, at the mouth of the Raho river. The outlet of this lagoon is at Little Popo, to the east of the Togo territory. Popo is not claimed as German upon the map.

GEOLOGY AND PALÆONTOLOGY.

The Relations of the Palæozoic Insects.—At the April, 1885, meeting of the National Academy of Sciences, Mr. S. H. Scudder presented some important views as to the position of the insects of the Palæozoic age in the system. We make the following extracts from his paper:

The modification I would introduce is to this effect: That

while we may recognize in the Palæozoic rocks insects which were plainly precursors of existing Heterometabola, viz., Orthoptera, Neuroptera (both Neuroptera proper and Pseudoneuroptera). Hemiptera (both Homoptera and Heteroptera) and perhaps Coleoptera—and no Metabola whatever—a statement almost identical with that previously made, we may yet not call these Orthoptera, Neuroptera, etc., since *ordinal features were not differentiated;* but all Palæozoic insects belonged to a single order which, enlarging its scope as outlined by Goldenberg, we may call Palæodictyoptera; in other words, the Palæozoic insect was a generalized Hexapod, or more particularly a generalized Heterometabolon. Ordinal differentiation had not begun in Palæozoic times.

The grounds for this view are as follows:

1. No group of Palæozoic insects has yet been studied carefully; and it is important to observe that, though our knowledge of them is of necessity fragmentary, yet the more perfectly they are known the clearer is this true; no group, I say, has been carefully studied which does not show, between it and the modern group which it most resembles, differences so great that it must be separated from that group as a whole, as one of equal taxonomic rank, as in the case of three relative groups last mentioned.

2. That the different larger groups of Palæozoic times, of which we now know nine or ten, were more closely related to one another, at least in the structure of their wings (which is the only point of general structure yet open for comparison) than any one of them is to that modern group to which it is most allied, and of which it was, with little doubt, the precursor or ancestral type. Thus the Palæoblattariæ are more nearly allied in the ground structure of their wings to certain neuropteroid Palæodictyoptera of Palæozoic times than to the modern Blattariæ; and yet we can so completely trace in Mesozoic times the transition from the Palæoblattariæ to the Blattariæ that no reasonable doubt can exist as to their descent, the one from the other.

3. The ordinal distinction which is now found in the wing structure of modern insects did not exist in Palæozoic insects, but a common simple type of neuration which barely admitted of family division.

It will appear from this that, by a sort of principle of family continuity, we may recognize in the Palæozoic insects a tendency toward a differentiation in ordinal characters sufficient to enable us in an *ex post facto* fashion to distinguish between orthopteroid, neuropteroid, etc., Palæodictyoptera.

Now when we look at the insects of later formations, we find types of every one of the existing orders of insects—speaking of these orders in their broadest sense, as we have everywhere done in this essay—we find every one fully developed in the Jurassic period.

We find then that the entire change from the generalized hexapod to the ordinally specialized hexapod was made in the interval between the close of the Palæozoic period and the middle, we may say, of the Mesozoic. These significant changes were ushered in with the dawn of the Mesozoic period, and the Triassic rocks become naturally (together with the Silurian) the most important, the expectant ground of the student of palæontology.

Hitherto for fifty years the Carboniferous period has claimed this interest as its birthright.

It would then appear that the geological history of winged insects, so far as we know from present indications, may be summed up in a very few words. Appearing in the Silurian period, insects continued throughout Palæozoic times as a generalized form of Heterometabola which, for convenience, we have called Palæodictyoptera, and which had the front wings as well as the hind wings membranous.

On the advent of Mesozoic times a great differentiation took place, and before its middle all of the orders, both of Heterometabola and Metabola were fully developed in all their essential features as they exist to-day, the more highly organized Metabola at first in feeble numbers, but to-day, and even in Tertiary times, as the prevailing types. The Metabola have from the first retained the membranous character of the front wings, while in most of the Heterometabola, which were more closely and directly connected with Palæozoic types, the front wings were, even in Mesozoic times, more or less completely differentiated from the hind wings as a sort of protective covering to the latter, and these became the principal organs of flight.

GARMAN ON DIDYMODUS.—Mr. Samuel Garman has published a description[1] of the shark *Chlamydoselachus anguineus* Garm., and introduced into his paper some comments on my paper[2] on the extinct shark Didymodus, which has been found in the beds of Permian age in Texas. Mr. Garman's comments are in the form of a criticism which denies the existence of some of the leading points of structure of the skull which I have pointed out. The surprise which these criticisms occasion increases when it is understood that they are derived "from a study of the illustrations," and not of the specimens themselves. And Mr. Garman appeals to "a comparison with the plate in the Proceedings" (of the American Philosophical Society) to "show whether they can be justified" (p. 29). To utter the sweeping conclusions reached by Mr. Garman on such a basis as this, is, to say the least, hazardous; and it is a comparatively easy task to show that they are wrong, by reference to the specimens themselves. On p. 573 of

[1] Bulletin of Museum Comparative Zoölogy, Cambridge, XII, July, 1885.

Proceedings American Philosophical Society, Philadelphia, 1884, p. 572.

my essay I state that twelve more or less complete crania of Didymodus are in my possession. I now add that most of them were in my possession, and were objects of frequent observation by me, for five or six years before my publication in question.

On p. 29 of his brochure, Mr. Garman says:

"3. The skull is unsegmented; the lines of segmentation, so-called, are partly accidentals which are not alike on the two sides of the skull."

To this it must be replied that the lines of segmentation certainly exist, and that they are alike on the two sides of the skull.

"6. The Fig. 4 of the plate should be reversed in direction, the prolonged anterior portion in the figure should be turned backwards from the interorbital region, thus bringing what in the figure serve as orbits behind the postorbital processes."

As I have several perfect skulls of this species, including the one represented in Fig. 1, where the characters are readily seen, the supposition of Mr. Garman that I have reversed the specimen represented in Fig. 4 is simply curious; and as he derives his information from a plate, one is also surprised at the lack of caution exhibited in making the assertion.

"7. The Ichthyotomi, as based on these skulls, have not been separated from the Selachii."

The suborder Ichthyotomi was thus defined in my paper (p. 581): "A basioccipital bone and condyle. Occipital ? pterotic and frontal bones distinct. Supraorbital (or nasal) bones present." Mr. Garman gets over this definition by denying the existence of the segmentation, which, as we have seen, nevertheless exists; and by ignoring the presence of the basioccipital bone and condyle. This would indeed be the muzzle of the skull, were the direction of Fig. 4 reversed, as proposed by Mr. Garman. As the characters above given are proven to exist, I must still regard the genus Didymodus as presenting a type of skull quite different from the true Selachii.

I now add a few comments on other points in Mr. Garman's paper. On p. 21 of his essay Mr. Garman gives five references to the publications where he claims that I have called the *Chlamydoselachus anguineus*, *Didymodus anguineus*." I have, however, never proposed or used this name at the places cited, or elsewhere. On p. 28 it is stated that I have never published my conclusion that these two genera are distinct. This was done in the AMERICAN NATURALIST, 1885, pp. 236–7. Further, a new name is proposed as a substitute for Didymodus (p. 30), because the latter is supposed to have became a synomyme in another connection. Were this the fact, I should still retain as unused the name Didymodus, by which the form is now known; but as it has not yet been positively shown to be distinct from some of the various genera of this group already proposed, the action of Mr. Garman is at least premature.—*E. D. Cope.*

ON THE ANTHRACARIDÆ, A FAMILY OF CARBONIFEROUS MACRUROUS DECAPOD CRUSTACEA, ALLIED TO THE ERYONIDÆ.[1]—Having been kindly favored by Messrs. R. D. Lacoe and J. C. Carr with the opportunity of examining their collections of nodules from Mazon creek, containing *Anthrapalæmon gracilis* Meek and Worthen, I have been able to discover some features probably not shown in the specimens examined by those palæontologists. The newly observed characters are the carapace with its rostrum, showing that the American species in these respects closely resembles the European ones figured by Salter, the founder of the genus. Moreover, specimens show the entire thoracic legs, while the antennæ of both pairs were almost entirely shown. The fact that the first pair of thoracic feet were scarcely larger than the succeeding pairs shows that Anthrapalæmon cannot be placed in the Eryonidæ, but should form the type of a distinct group of family rank, none of the existing Macrura having such small anterior legs. At the same time the Carboniferous Anthracaridæ were probably the forerunners or ancestors of the Mesozoic and later Eryonidæ.

The genus Anthrapalemon, a Carboniferous fossil, was first described by J. W. Salter in the Quarterly Journal of the Geological Society of London, (XVII, 529, 1861). The name given to the fossils has, the author remarks, "only a general signification, and is not intended to indicate a real relation to Palæmon." He also remarks that "the genus is not to be confounded with any of the Liassic or Oölitic ones published by von Meyer, Münster, &c. * * * It is broader than the general form of the Astacidæ, or than Glyphæ and its Liassic allies, but much narrower than Eryon." Salter's type species is *Anthrapalæmon grossarti* Salter. With this species the American *A. gracilis* is congeneric. A closely allied English form of *A. dubius* Prestwich, is referred by Mr. Salter to the subgenus Palæocarabus, a name less fitting than Anthrapalæmon. The telson, unlike that of any other macruran, fossil or recent, so far as I am aware, is differentiated into three portions: the basal, central piece is somewhat polygonal, a little longer than broad; it is separated by a distinct suture from a small triangular terminal piece which forms the apex of the telson. Between the outer half of the entire telson is a large broad lobe which is fringed with setæ. At first I regarded it as a subdivision of the inner lobe of the last uropoda or abdominal feet, but no instance among the Decapoda is known to us in which the last pair of uropoda have more than two lobes or divisions, and I have therefore been inclined to associate the innermost of the three setiferous lobes with the telson, and to regard the telson as divided into two median and two lateral lobular setiferous portions. Whether the two lobes belong with the telson or uropoda I will leave for the present an open question.

[1] Read before the National Academy of Sciences, April, 1885.

The only group in existence in which the telson is so remarkably differentiated is the Galatheidæ. In Munida the telson is divided by sutures into four pieces, the two terminal ones lobed and edged with setæ of the same size as those of the uropoda. In Eumunida of Smith the telson is "short and broad, more or less membranaceous, and divided by a transverse articulation, so that the distal part may be folded beneath the basal part." In *Anoplotus politus*, like the foregoing a deep-sea galatheid, the telson is stiffened by eight distinct calcified plates, a broad median basal plate, with a small one on either side at the base of the uropod and a small median one behind it and between a pair of broad lateral plates, still behind which there is a second pair which meet in the middle line and forms the tips and lateral angles.

From the nature of the differentiation of the telson in the Galatheidæ I am inclined to believe, from what I have observed in the specimens before me, that the telson of Anthrapalæmon is sub divided in nearly the same manner. If so we cannot refer the genus to the Eryonidæ, and we would therefore regard it as the type of a distinct family which may thus be briefly characterized:

Family Anthracaridæ: Body broad and somewhat flattened, in general appearance like the Eryonidæ, but with the first pair of thoracic legs no larger than the four succeeding pairs; carapace with a long acute rostrum, with lateral spines on the anterior half, the telson differentiated into two median pieces, with two lateral broad rounded membranaceous lobes, fringed like the uropoda with large setæ.

In anticipating the differentiated telson of the anomurous Galatheidæ, this eryon-like shrimp is not an exception to the rule prevailing in the old-fashioned Carboniferous forms, which seem, in most cases, to be synthetic or ancestral types. The Eryonidæ, which began to exist in the Mesozoic age, have persisted to the present time, being represented by certain deep-sea forms, *i. e.*, Willemœsia and Pentacheles; on the other hand the Anthracaridæ appear to have become extinct at the end of the Palæozoic age, and the question naturally arises: Did they stand in an ancestral relation to the Mesozoic and modern Eryonidæ? Appearances certainly indicate that the Eryonidæ, and perhaps the Astacidæ, may have descended from a group at least closely allied to the Anthracaridæ.—*A. S. Packard.*

The Geological History of New Zealand.—Capt. F. W. Hutton, in an article upon the origin of the fauna and flora of New Zealand (*Ann. and Mag. Natural History*, February, 1885) arrives at the following conclusions: New Zealand, which formerly existed as the southern part of a continent extending through Australia to India, was isolated from Australia toward the close of the Jurassic period, but was attached to a South Pacific continent and received a stream of immigrants

from the north. None arrived from the south because Fuegia was not then in existence. In the Upper Cretaceous the land shrank to a size considerably smaller than at present. In the Eocene, elevation took place, and New Zealand extended outwards in all directions, but remained isolated. Plants and animals came in both from the north and from the south. In the Oligocene and Miocene periods New Zealand was, except for a short interval, a cluster of islands, but was upraised once more, and obtained more immigrants from north and south during the Pliocene, after which subsidence occurred, and the land throughout the South island and southern half of the North island sank considerably below its present level, to be again elevated during the Pleistocene.

GEOLOGICAL NEWS.—*Jurassic.*—M. Cotteau has studied more than 500 Echini from the Jurassic of France. The Jurassic seas, not very deep, with broken shores, numerous isles and many extensive coral reefs, presented conditions eminently favorable for the existence of Echini. The evolution of the fifty genera described by M. Cotteau is of great interest. Some are special to the beds they occur in, and nothing in the beds above recalls their existence, while others have a curious persistence. Cidaris has subsisted from the Trias to the present day.

Cretaceous.—Herr A. Schenk has described the fossil woods of the Libyan desert belonging to the Upper Cretaceous. Many are petrified. —— At the Academy of Sciences of Paris (May 25), M. Hebert presented a note by M. Ch. Velain upon the Penean formation, which in the Vosges takes a large share in the constitution of the secondary chains, filling some very large depressions. Except at some points where it is raised to the summit of mountains 600 to 800 meters high, it is covered by the Vosgian sandstone, and it lies upon the Carboniferous or gneiss. It is usually a red clayey sandstone, passing into a fragmentary conglomerate which unites it to the Vosgian below.

Tertiary and Quaternary.—The British Eocene land Mollusca are treated of by J. S. Gardner, in the *Geological Magazine* for June, 1885.——C. Schwager enumerates the foraminifera of the Eocene of Egypt and the Libyan desert. About sixty new species are described, excluding the nummulites which have been monographed by P. de la Harpe, and of which twenty-five species occur. The Eocene corals of the same region have been described by E. Pratz.——Messrs. P. M. Duncan and W. P. Sladen have monographed the Tertiary Echinoidea of Kachh and Kattywar (Palæontologia Indica, Ser. XIV). The Eocene of this region is classified in four groups, the two uppermost of which contain Echini. In the nummulitic group of Kachh twenty-two species were found, in the Oligocene above it five species, and in the Miocene sixteen species. All the Echini of Kattywar were Miocene, and

of the thirteen species six occurred in the Miocene of Kachh. Thirty-one of the foregoing are new. The same authors have monographed the Echini of Scinde, in all twenty-six genera and forty-two species, about twenty-six of which are new.——Th. Fuchs has described the Miocene fauna of Egypt and the Libyan desert. His work brings the neogene species of Lower Egypt up to 129. The new species are *Turritella distincta*, *Pholas ammonis*, *Pecten zitteli*, *fraasi* and *geneffensis*, *Ostræa vestita* and *pseudo-cucullata*, *Placuna miocenica*, *Brissopsis fraasi*, *Agassizia zitteli*, *Echinolampas amplus*, *Clypeaster rohlfsi*, *sub-placunarius* and *isthmicus*, *Scutella ammonis* and *rostrata*, and *Amphiope truncata* and *arcuata*. ——*Cervalces americanus* Scott = *Cervus americanus* Harlan, is described by Professor W. B. Scott (*Science*, 1885, 420) from an almost perfect skeleton found in Warren county, N. J. It was a very large animal, with large head, short neck and trunk, legs much longer than those of the great Irish deer, and antlers which were palmated, though less so than in the moose. There is a bezant antler and a posterior tine given off from the beam opposite to it. The two tines are connected by a flaring process of bone which descends below the level of the eye. The premaxillæ are stag-like, and join the nasals, which are much longer than in the moose. The nostrils were smaller, and there was evidently no such a proboscis-like snout as in the moose. Cervalces agrees with the moose in having the lower ends of the lateral metacarpals present, and on the whole is more like Alces than it is like Cervus.——Professor Owen (Trans. Zoöl. Soc. London, 1883) describes the skeleton of *Dinornis parvus*. This smallest of the genus has proportionally the largest skull.——The *Geological Magazine* for April contains an interesting article upon the oscillations of level on the south coast of England. The May issue of the same magazine has an account of the inland seas and salt lakes of the glacial period, by T. F. Jamieson.——A new locality for diamonds is Salobro (brackish) behind the flat coast of the southern part of the province of Bahia, near the junction of the Rio Purdo with the Jequitinhonha, at the foot of the Serra do Mar. The diamonds occur in a disintegrating clay, apparently of quite recent origin, resembling the alluvium of existing rivers, and not exhibiting that rounding of the materials usually so characteristic of Brazilian diamond sands. It encloses few minerals compared with other sands; quartz is most common, next monazite in yellow and red crystals and zircon in brown to white, but seldom violet crystals; while staurolite, almandine, corundum and various iron ores are rarer. This is the first occasion in which corundum has been found in diamond beds, while tourmaline and other characteristic minerals are wanting.——Mr. D. Pidgeon (Quart. Jour. Geol. Soc.) gives an account of some recent discoveries in the submerged forest of Torbay, Eng., and maintains, contrary to received opinion, that "while some of the so-called peat-beds

of the forest are not older than Roman times, the clays in which the forest is rooted are either coëval with or younger than the bronze age in Britain." In December, 1883, the sea tore away the beach so as to expose this clay, at the junction of which with the Trias were found hearths of trap rock with bits of pottery, grindstones, glass, tin, slag and ingots of copper, leading to the conclusion that tin was smelted and bronze made prior to the deposition of the forest clay upon the surface of the Trias rock. Submergence need not be predicated, the damming back of the sea and the growth of trees below high-water mark behind the dam furnish a probable explanation of the phenomena.

MINERALOGY AND PETROGRAPHY.[1]

AMPHIBOLE-ANTHOPHYLLITE FROM MT. WASHINGTON, BALTIMORE COUNTY.—A light-gray or brownish colored mineral, with a bronzy luster, occurs in considerable quantity as a gangue of the chalcopyrite ore which is mined a short distance north-west of the village of Mt. Washington, Baltimore county, Md. It is most frequently found in thin blade-like individuals varying much in size and with only faint indications of crystal planes. Such masses contain, beside the chalcopyrite, abundant, sharply defined octahedral crystals of magnetite. The bronzy mineral has a fibrous structure and in all respects resembles anthophyllite. During the past fall blades of unusual size ($10^{cm} \times 2^{cm}$) were found, which had the planes $\infty P \overline{\infty}$ and ∞P of the prismatic zone well developed. The angle between the planes of the prism (124° 30′) placed the hornblendic nature of the mineral beyond a doubt. The great purity and transparency of some of the material seemed to invite a chemical and optical examination which was accordingly undertaken by Mr. C. S. Palmer, of the chemical laboratory of the Johns Hopkins University. Some specimens of a reddish-brown color were translucent—almost transparent—though 2^{mm} in thickness. In these the usual fibrous structure parallel to the vertical axis was hardly noticeable, but a parting parallel to a very flat clinodome was quite pronounced.

A chemical analysis of this freshest and most homogeneous material gave the following results:

SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	K_2O	total
57.26	0.75	1.73	15.64	tr.	21.70	2.80	tr.	99.88

This will be at once recognized as the composition of a typical anthophyllite. The specific gravity is 3.068. No pleochroism is visible in thin sections, but in transparent crystals of considerable thickness a decided difference both in the color and intensity of the rays is observable. The one vibrating parallel to $\dot{c}$ is a light copper-red, while that parallel to $\bar{b}$ is yellow. Absorp-

[1] Edited by Dr. GEO. H. WILLIAMS, of the Johns Hopkins University, Baltimore.

tion $\dot{c} > \bar{b}$. No satisfactory sections parallel to the clinopinacoid for the determination of the a ray were obtained. In converged polarized light sections parallel to $\infty P\bar{\infty}$ showed one optical axis somewhat out of the field, so that only a dark brush was seen to pass as the stage was revolved. The exact measurement of the extinction in sections parallel to the clinopinacoid was not easy on account of the fibrous character of the mineral. Different values were obtained on different fibers, the largest and most frequent being from 22°–25°.

There can therefore be no doubt that this mineral is really monoclinic in spite of its chemical composition and general resemblance to the orthorhombic anthophyllite. This fact is of interest in connection with the observations of Des Cloizeaux on an exactly similar mineral from Königsberg and Greenland, for which he first proposed the name amphibole-anthophyllite.[1] Groth has remarked that a considerable proportion of the minerals commonly called anthophyllite are probably monoclinic in their crystallization.[2] Zeparovich has recently noted the occurrence of amphibole-anthophyllite at Schneeberg in Passeyr.[3]—*G. H. Williams.*

New Planes on Hornblende Crystals.—In Vol. VIII of his Materialien zur Mineralogie Russlands, 1881, N. von Kokscharow enumerates eighteen forms as heretofore observed on the mineral hornblende. Of these five only b ($\infty P\bar{\infty}$), e ($\infty P\bar{3}$), M (∞P), u ($\infty P\bar{3}$) and a ($\infty P\bar{\infty}$) belong to the prismatic zone. One other, g ($\infty P\bar{2}$) was added by Franzenau from his studies of the hornblende from Aranyerberg, in Hungary.[4]

Certain dark-green crystals of hornblende (pargasite) occurring at East Russell, St. Lawrence county, N. Y., although having but few lusterless terminal planes, possess in the prismatic zone a wealth of forms which has never before been observed on this mineral. All the above-mentioned planes, a, n, g, M, e and b, were determined by measurement, and also two others, x ($\infty P5$) and y ($\infty P7$). Accepting the axial ratio of von Kokscharow a : b : c = .548258 : 1 : .293765 — β = 75° 2′, the angle between these planes and the clinopinacoid b are

	measured	calculated
For x	159° 23′	159° 18′ 48″
For y	165° 8′	164° 54′ 20″

On these crystals, as usual, the planes a, n, M, e and b are the commonest, g and x are, however, not uncommon; y was observed on only one crystal, where it was bright and well developed.—*G. H. Williams.*

[1] Nouvelles Recherches sur les propriétés optiques des cristaux, 1867, p. 114.
[2] Mineraliensammlung der Universität Strassburg, 1878, p. 228. Tabellârische Uebersicht der Mineralien, 1882, p. 105.
[3] "Lotos," 1883.
[4] Zeitschrift für Krystallographie, VIII, 1883, p. 568.

LEUCITE. — Professor H. Rosenbusch[1] of Heidelberg, has recently made the most interesting observation that the morphological no less than the optical characters of the mineral leucite can be brought into full accord with the regular system by a sufficient increase of temperature. It is well known that this mineral was regarded as the very type of an isometric icosatetrahedron until vom Rath showed that considerable variation from the calculated angles as well as frequent twinning lamellæ parallel the face $_{\infty}O$ necessitated the assumption of a tetragonal symmetry. The double refraction of this substance was also a point in favor of this view. The recent studies of Klein, Merian and Penfield have, however, shown that above a certain temperature leucite, like boracite, becomes altogether isotropic and now Rosenbusch finds that by the same means the twinning lamellæ, ordinarily visible as a system of fine striations, may likewise be made to disappear. A crystal upon which these were unusually distinct was brought in focus under the microscope by reflected light in such a manner that the main face appeared bright while the lamellæ were in the shadow. Heat was now gradually applied and the most remarkable effect observed. A kind of undulatory motion was noticed and whole groups of lamellæ would disappear at one point and reappear at another, until finally, at the requisite temperature, all were gone and the face was seen to be quite uniform and even. Upon cooling the lamellæ returned but in a different position from that which the original ones occupied. So great was the molecular disturbance here produced, that after some repetitions of the experiment on the same crystal it fell to pieces. The supposition is made that leucite crystallizes in the regular system at high temperatures, and in some other unknown system at ordinary temperatures. The effort of the molecules to suit their arrangement to the altered conditions produces a tension which finds relief in the formation of secondary twinning lamellæ parallel to the slipping plane ("gleitfläche"), which in this case is $_{\infty}O$. When the temperature is raised this tension is of course removed. The attempt will be made by the same investigator to measure a crystal of leucite on a reflection goniometer at the temperature necessary for the obliteration of the twinning lamellæ, when it is expected that the interfacial angles will agree perfectly with the regular symmetry.

BOTANY.[2]

THE ABUNDANCE OF ASH RUST.—In Eastern Nebraska, this year has been remarkable for the great abundance of the ash rust (*Æcidium fraxini*) upon the leaves, petioles and twigs of the green ash. In many instances each leaflet contained from ten to

[1] Neues Jahrbuch für Min., etc., 1885. II, p. 1.

[2] Edited by PROFESSOR CHARLES E. BESSEY, Lincoln, Nebraska.

twenty of the characteristic spots, varying from a tenth to a quarter of an inch in diameter. The petioles and partial petioles were frequently greatly distorted and enlarged, and in many cases the young twigs were swollen out into rounded nut-like growths which were covered with the tubular Æcidia.

The injury produced by this rust in Lincoln was quite considerable, as green ash trees have been very largely planted along the streets for shade and ornament. These planted trees appear to have suffered more than the native ones along the streams, although the latter were by no means free from the parasite.

I have as yet been unable to obtain any clue to the further development of the ash rust. One would look for a correspondingly great growth of red and black rust upon some of the plants of this region, but so far I have not observed any indication that such is the case.—*Charles E. Bessey.*

THE FERTILIZATION OF THE WILD BEAN (*Phaseolus diversifolius*).—The flowers (Fig. 1) of the wild bean when fresh are of a pretty rose-purple color, turning to a sort of dirty flesh color in fading. This change of color occurs at a time when insect visits are no longer necessary to the flower and no doubt serves to inform the insect that it has no food to offer. The two wings are free from the keel but lie close to it; they furnish an *alighting* place

Fig. 1.

Fig. 3.

Fig. 2.

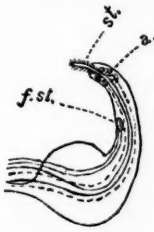

Fig. 5.

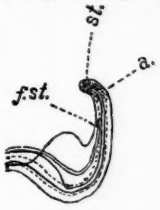

Fig. 4.

FIG.—Flower of wild bean, seen somewhat from below. FIG. 2.—Keel and wings. FIG. 3.—Keel alone, showing lens-shaped base. FIG. 4.—Enlarged section of keel with style enclosed. FIG. 5.—The same with style projecting; *st*, stigma; *f. st*, free stamen; *a*, anthers of connected stamens. The dotted lines indicate the course of the united filaments.

for the middle-sized bees which visit it (Fig. 2). The keel itself has the form of a vertically placed lens at its base, narrowing above into a narrow tube, which encloses both stamens and styles (Fig. 3). The anthers lie about the hairy end of the style and shed their pollen upon it. After this has escaped the free ends of the filaments shrivel up and allow the somewhat freer movement of the style. The anthers never leave the keel. Nine of the stamens are united by their filaments, but the tenth is free. In

their natural state both stamens and style are included by the keel and lie along the lower portion of the dilated part of the keel (Fig. 4).

When a bee visits the flower it alights upon the wings on the left side of the keel. In its struggles to get at the honey, it pushes down the wings, these carry with them the keel, and their combined motion forces out the hairy end of the style, while the peculiar curvature of the keel directs its stigma to the side and back of the bee (Figs. 5 and 1). In this act the stamens and style are in reality passive. They lie at first along the bottom of the keel, the depression of the keel pulls it away from the stamens and draws its tube down from the style, the small opening at its end forbidding the extrusion of the stamens. The pollen collected on the hairs of the style is left on the back of the bee and the stigma receives fresh pollen from some other flower which had been left on the back of the insect during some previous visit. As soon as the bee leaves the flower the parts again resume their normal position. The mechanism of the flower is similar to that of *Ph. vulgaris*, but lacks the double spiral of the keel.—*Aug. F. Foerste, Granville, Ohio.*

The Movement of Protoplasm in the Styles of Indian Corn.—It will not be too late when this appears in print for students in botanical laboratories to study the movement of the protoplasm in the long styles ("silks") of the Indian corn. By taking a young style from an ear which has been kept in a warm place for an hour or so, clipping off a piece a couple of inches in length and carefully mounting it in water under a large coverglass, there will be no difficulty in seeing a great deal of activity in the protoplasm. Care must of course be taken to have the style lie flat, remembering that it is not cylindrical in shape, but somewhat ribbon-shaped. The cells are much elongated and the walls are so transparent that with careful focusing their contents may be seen, even in the interior parts of the style.

The protoplasm is sufficiently granular to be easily seen. It moves along the side of the cell in a strong steady stream, occasionally heaping up a great mass, which is eventually pushed onward by the current. As an easily obtained and instructive example of protoplasmic activity I know of nothing which is superior to such a specimen.—*Charles E. Bessey.*

Bacteria as Vegetable Parasites.—The only genuine instance of parasitic bacteria in plants yet mentioned in the books (De Bary, Zopf, etc.) is that of the yellow sickness of hyacinths, first described by Dr. Wakker, of Amsterdam, in 1882. This bacterium winters in the bulb scales, and increases in the spring to slimy yellow masses which destroy the tissues and eventually kill the plant. The priority of demonstrating parasitic bacteria in plants belongs, however, to an American. In 1880, two years

before Dr. Wakker's announcement of bacteria in hyacinths, Professor T. J. Burrill, of Illinois, presented a paper before the American Association for the Advancement of Science demonstrating the invariable presence of characteristic bacteria in the disease known as "pear blight," which attacks pomaceous trees, and that the disease may be transmitted from tree to tree by inoculation. Since then the bacteria have been isolated and cultivated in artificial media, and the statements of the original paper fully confirmed. Americans should have credit for what little original work they do accomplish in bacteriology.—*J. C. Arthur, in Botanical Gazette.*

Work for the Botanical Club of the A. A. A. S.—This organization, with its large yearly attendance, may well undertake some work which has been long neglected in this country. We do not forget that the principal object of its founders was to bring the botanists together for social purposes, and are rejoiced to know that in this respect it has accomplished much. Many of the lonely botanists living in remote parts of the country have been gladdened and encouraged by meeting their fellows and consulting upon means and methods. This result is in itself a justification of the existence of the club.

But this should not be all. At every annual meeting some progress should be made in the effort to bring about concerted action among the botanists of the country with regard to many matters. We will venture to suggest here some things which might well occupy a part of the time of the club.

1. In view of the rapid increase in what may be termed popular cryptogamic botany, it is desirable that there should be uniformity in the use of English names of the species and groups. For example, to what group shall we apply the name of the mildews? or the blights?

2. Cannot the botanists do somewhat to bring about greater uniformity in the pronunciation of botanical names and terms? That this is needed requires no further demonstration than that afforded by a single session of the club. We believe that the time is not far distant when botanists must listen to our Latin scholars, and take steps which shall lead to a pronunciation in conformity with what is now regarded as the best Latin usage.

3. The question of the publication of botanical papers (aside from those of systematic interest) may well demand attention. We have several journals devoted to botany alone, and several others maintaining botanical departments. Now, might it not be well to provide for a "division of labor" here, so that each journal might develop its particular branch or department? Moreover, might not the club arrange for a more general distribution of botanical papers (articles) by a general system of exchange?

4. The relations of the botanists of the country to the National Herbarium might be made the subject of discussion and action,

with profit, we apprehend, to the botanists and also to the National Herbarium.—*Charles E. Bessey.*

Botanical News.—The subject of bacteriology received especial attention in the July number of the *Botanical Gazette*, there being no less than a dozen notes and notelets devoted to it, besides four reviews of books upon the same subject.——Clara E. Cummings, of Wellesley, Mass., has prepared a neat catalogue of the Musci and Hepaticæ of North America north of Mexico, which will prove useful to botanists who collect specimens in these classes of plants. The arrangement of the mosses is based upon Lesquereux and James' Manual of Mosses, and that of the liverworts upon Underwood's Catalogue of the North American Hepaticæ. There are enumerated 888 species of mosses and 231 of liverworts, besides many varieties. Copies may be procured of the author for thirty-five cents each.——The Bulletin of the Brookville Society of Natural History, recently issued, contains two articles of botanical interest, viz., The Flora of Franklin county (Indiana), by O. M. Meyncke, and Microscopical Notes, by E. G. Grahn. The former is restricted to the "exogens," and is little more than a bare list, containing but few notes. The second paper contains a list of diatoms and desmids.——A late number of the Bulletin of the Chicago Academy of Sciences contains a readable paper by W. K. Higley on the Northern pitcher plant, or the side-saddle flower (*Sarracenia purpurea* L.). To it are appended several tables of chemical analyses of the fluid contained in the pitchers. It appears that its acidity, which may be very slight at the beginning, increases with the age of the leaf. The acids detected were hydrochloric, sulphuric, carbonic, malic and citric, and respecting these our author says: "To just what acid, if any particular one, the reaction was due in the liquid of the earlier pitchers is not certain, but in the two last months both malic and citric acids appeared, the former in great abundance." As to the origin of the fluid Mr. Higley says: "As a result of the examination of over eight hundred leaves, I find that none contained any fluid before they had opened. These were collected from several localities. After opening there is no fluid till after the first rain, except in a few cases when there has been a heavy dew."——The July *Journal of Botany* contains an interesting review (by Häkel) of Nägeli and Peters' Hieracien Mittel-Europas. The number of species is 164, but the subspecies, varieties and sub-varieties bring up the number of "kindreds" to 2000. In discussing their relationships "it is shown that the kindred forms are of unequal systematic value, and that the species consists partly of individual kindred forms and partly of groups of them."

ENTOMOLOGY.

A NEW SPECIES OF CRAMBUS INJURING CORN ROOTS.—On the 7th of June, 1883, my assistant, Mr. Webster, who had been detailed to study the work of the black-headed grass maggot in corn fields, brought to the office some supposed cutworms, bristly reddish larvæ, which he had found gnawing the roots of corn below the surface, in fields in McLean county, on both old and new ground.

They were not seen again during this season, but on the 19th May of the present year I received the same species from Mr. E. Gastman, superintendent of public schools at Decatur, with the information that they had been sent him from Harristown by a farmer who reported that they were doing serious damage to the roots of his young corn.

On the 27th May, I visited Dwight for the purpose of searching the fields of Mr. Mills from which the web worm had been sent me. The corn in this field was injured most in patches. Over one area of about one-fourth of an acre, many hills were missing, and fully one-third of those remaining were damaged, with a plant occasionally killed. Upon digging into the affected hills the caterpillars were found just beneath the surface, sometimes as many as five or six in a hill, each in a retreat formed by loosely webbing together a mass of dirt irregularly cylindrical in shape, one and one-half to two inches long, and about one-half an inch in diameter. The worm was found in a silk-lined tube within this mass (the tube not always perfectly constructed), which in some cases opened at the surface, its presence being indicated by a circular opening about the size of wheat straw, in the earth next a stalk of corn.

The first attack upon the plant was made by gnawing the outer surface beneath the ground and above the roots. Occasionally the stalk was completely severed, as by a cutworm, but usually not, the larvæ showing rather a disposition to work upwards, eating a superficial furrow or burrowing lengthwise along the center of the stem. In other parts of the field, only here and there a stalk was attacked. The foliage was also frequently eaten, the lower leaf first and then the upper ones, the larva evidently leaving its burrow for this purpose. The tips of the leaves were eaten off, or irregular elongate holes were eaten through them—probably at night, as I have never seen the larva abroad by day. Where the corn was largest, webbed masses of dirt were frequently found which contained no larvæ, a fact which I was at first inclined to suppose indicated that the insect inhabiting them had transformed, especially as the larvæ found were of quite uniform size and apparently full grown. I failed to find a single pupa, however; and as our breeding experiments did not yield the insect for more than a month, it seems more likely that these empty webs had

been abandoned by worms which had gone in search of younger stalks.

On the 7th June, after several hours of careful search in cornfields near Lexington, McKean county, where I selected by preference the least thrifty fields, I found no living larvæ, and but a single mass of webbed dirt at the base of a stalk precisely similar to those formed by the web worm, the hill containing it having been evidently damaged some time before.

A number of the larvæ were brought to the office and placed in earth in a breeding cage on the 28th May. On the 14th June those in the breeding cage were transferred to fresh corn. Many of them were dead, but nine active specimens remained. On the 30th the corn was renewed and another search was made. No larvæ were found and but two living pupæ. A single imperfect moth was released from the earth in which it had completed its transformations, but it was not able to expand its wings and could not be determined. One of the other pupæ was unfortunately crushed by accident, and the other was badly infested by mites which clung closely to its crust about the head with inserted beaks. These were carefully picked away, and this sole remaining pupa was returned to thoroughly calcined earth to complete its transformation. On the 22d July it emerged as a small gray moth, evidently belonging to the family Pyralidæ.

From Professor C. H. Fernald, to whom I referred the specimen, I learned that it was a species of Crambus, new to him and probably undescribed. It is described as *Crambus zcëllus* Fernald, and is known to inhabit Maine, Penna., W. Va., Illinois and Missouri. On the 3d July Mr. Mill, of Dwight, wrote me that the larvæ had almost entirely disappeared from the corn fields, and that the season had been so favorable to the crop that no perceptible damage had finally resulted, with the exception of the loss of a few hills here and there.

The small size of the individuals observed earliest in the season perhaps makes it possible that they came from the egg last spring; and the brood represented in our collections must have completed its development by the end of July. Whether a second brood appears is altogether uncertain.

The injuries inflicted occur so early as to permit replanting in most seasons in case they should prove to be of serious import; and this species is consequently to be classed with the cutworms so far as the effect of its injuries to corn are concerned.—*S. A. Forbes, from advanced sheets of Report of State Entomologist of Illinois for 1884.*

Unusual Abundance of Grasshoppers in Colorado—Since the latter part of May Western newspapers have, from time to time, contained alarming reports of swarms of young locusts or grasshoppers in the valley of the Arkansas and in other portions

of the State of Colorado, and the fear was expressed that Kansas, Nebraska and Missouri would be visited by an invasion of the Rocky Mountain locust (*Melanoplus spretus*). Under direction of Professor Riley, Mr. Lawrence Bruner has visited the portions of Colorado from which rumors came. His report has just been received, and is of such a nature as to allay all fears.

The principal reports were from Salida, Rico, Cañon City and Pueblo. During his sojourn in the State he visited all points along the line of the Denver and South Pass R. R., between Denver and Leadville, and from Leadville followed down the Arkansas river, stopping at Buenavista, Salida and Cañon City, and then going to Granite, Pine creek, Garros and Como. In every locality visited, from which grasshoppers were reported, it was found that the numbers had been greatly exaggerated, and in no case was the migratory species found. All reports arose from a rather undue abundance of native species, which are present every year, and most of which have their preferred food plants in the shape of wild growth and noxious weeds.

Mimicry of a Dragon-fly by a Sumatran Butterfly.—By the margin of a small stream I caught *Leptocircus virescens*, which derives protection from mimicing the habits and appearance of a dragon-fly, in a crowd of which it is often to be found. In form it reminded me of the European genus Nemoptera. It flits over the top of the water fluttering its tails, jerking up and down just as dragon-flies do when flicking the water with the tip of their abdomens. When it settles on the ground it is difficult to see, as it vibrates, in constant motion, its tail and wings, so that a mere haze, as it were, exists where it rests.—*Forbes' A Naturalist's Wanderings in Sumatra.*

Edible Mexican Insects.—According to Mr. J. M. Carter, superintendent of the telegraph lines of the Mexican National R. R., to whom I was indebted for much kindness while in Mexico, the larva of an ant is eaten as food by the Otomite Indians; the ants living in oven-like hills.

Mr. Carter also told me that a caterpillar about two inches long, which lives within the thick leaves of the maguey or century plant, is eaten either raw or cooked by the Mexican Indians. It was not to be found in March at the time we were in Mexico, but in July, when it is often abundant. It is apparently a species of Noctuidæ.—*A. S. Packard.*

Entomological News.—Among the more remarkable insects of Turkestan, reports H. Lansdell in *Nature* for May 21, is a wingless saw-fly, related to the Selandriæ. Affected by this absence of wings, the thorax undergoes important changes, and appears greatly swollen, and all the females generally have the appearance of little bags.——Among the Orthoptera of Turkestan are two species of locusts whose ravages have been com-

plained of in the neighborhood of Perovsk, while a third kind called "pruss" have been destructive in the Zarafshan valley.—— In the *Annales des Sciences Naturelles* for Dec., 1884 (received in July, 1885). M. Viallanes publishes an important paper on the optic ganglion of *Æschna maculatissima*, illustrated by three phototypic plates. He also is working at the nervous centers of the Orthoptera.——A Naturalist's Wanderings in the Eastern Archipelago, by Henry O. Forbes, contains many interesting notes regarding the insect life of Java, Sumatra and the Moluccas, as well as Timor.——It appears from the report of Professor Snow, entomologist of the State Board of Agriculture of Kansas, that the Hessian fly has greatly increased in that State, having appeared in fifty-seven of the eighty-one organized counties. This increase in area of distribution is to be accounted for from the fact that the species is two-brooded, and that the second or spring brood made its presence felt in many counties in which the first brood was not sufficiently numerous to attract attention. A new destructive insect is the web-worm, a pyralid caterpillar whose ravages have been thus far confined to Kansas, and has been injurious to corn and potatoes. It is said to occur in Texas, where it is known as the cotton-worm.

ZOÖLOGY.

THE SKELETON OF THE MARSIPOBRANCHI.—Mr. W. Parker contributes to the Transactions of the Royal Society, 1883, a study of the skeleton of the marsipobranchs. At the outset he states that the hag and Bdellostoma are a greatly modified and arrested sand lance or Ammocete, and that a larval frog is also a marsipobranch. He remarks: I feel satisfied that the Anura have only gradually become metamorphosed, and I doubt whether *all the larvæ of Pseudis* undergo that change, even now." The adult lamprey, like the tadpole, is truly suctorial, but the mouths of the Ammocete or larval lamprey, and of the Myxinoids, are not modified into a circular sucking ring, but remain as a small hooded opening fringed with short barbels.

All the cartilage of the hag fish is *cephalic*, for even the farthest rudiment of the dorsal part of the branchial basket is supplied by the vagus nerve, and the spinal region is only supported by membrane or fibrous tissue. No cartilaginous rudiments of vertebral arches can be found. Notwithstanding the ammocetine type of the Myxinoids, they come near to the lamprey in some particulars, and in the perfection of the cranial basket-work, the specialization of the respiratory pouches, the presence of a prenasal median cartilage, and the cartilaginous rings which encase the long tube opening to the olfactory sac, they go beyond it, as also in the development of the *lingual* suctorial apparatus. Professor Huxley and Mr. Parker agree

in thinking that in the transformed lamprey there is a true mandibular rudiment.

THE STAR-NOSED MOLE AMPHIBIOUS.—On June 7th, 1885, we were favored with the opportunity to witness the skill and ease with which a star-nosed mole *(Condylura cristata)* propelled itself through the water. Standing near an expanded portion of a clear meadow brook, we noticed an object moving rapidly near the bottom. So swift were its movements that the eye was troubled to follow them. The zigzag course which the animal followed as it passed between the stones was suggestive of the movements of a frog, seeking refuge when frightened. After leaving the center of the pool it swam directly and rapidly to the opposite bank, keeping under the water all the time, and entered one of its galleries, which we afterwards found in trying to capture the specimen. A very interesting note on the amphibious habits of this mole was given by Dr. C. Hart Merriam in *Science*, Vol. IV, No. 92, Nov. 7, 1884, p. 429.—*A. K. Fisher, M.D., Sing Sing, New York, June, 1885.*

IRIDESCENCE IN THE OREGON MOLE.—In examining alcoholic specimens of *Scapanus townsendi* Bachman, from Klamath basin, Oregon, kindly presented to me by Captain Chas. E. Bendire, U. S. A., I have been surprised to observe a play of iridescent metallic colors, particularly when the animals were viewed by reflected light. The prevailing tints are purple, lilac, and bronze, often showing a rich coppery or brassy luster.

It was doubtless a similar condition which led Cassin to apply the names *S. æneus* and *S. metallescens* to an alcoholic specimen in the museum of the Philadelphia Academy.[1]

I am informed by Dr. Geo. E. Dobson, F. R. S., that the brilliant hues of the African genus Chrysochloris are much intensified by immersion in spirits.—*C. Hart Merriam.*

THE PINE MOUSE IN NORTHERN NEW YORK.—On the 13th of June, 1884, at my home in Lewis county, New York, I caught a female pine mouse (*Arvicola pinetorum* LeConte). It was taken in a trap baited with beechnuts and set for the red-backed wood mouse (*Evotomys rutilus* Gapperi) at the roots of a maple in the border of a hard-wood forest. This species has not been previously recorded from so far north in the Eastern States, Massachusetts having been given as the limit of its northern range. Its rarity appears from the fact that this is the only individual ever procured here, while of the common meadow mouse (*Arvicola riparius*) I have taken several hundred specimens.

[1] This was suspected by Professor Baird nearly thirty years ago, for he said: "I am not prepared to admit the *Scalops æneus* of Mr. Cassin as distinct from *S. townsendii*. The smaller size would belong to a young specimen, and the peculiar combination of the brassy color with the black nails and feet might be the natural result of long immersion of the animal in alcohol." (Pacific Railroad Reports, Vol. VIII, 1857, p. 67.)

The pine mouse is said to be common on Long Island, and Audubon and Bachman speak of it as "quite abundant * * * in the immediate vicinity of New York."[1]—*C. Hart Merriam, M. D.*

CAPTURE OF THE PINE MOUSE AT SING SING, NEW YORK.—Until the present year we have never detected the pine mouse (*Arvicola pinetorum*) in this locality. On Feb. 12th, 1885, a specimen was picked up on the road-side, dropped probably by some bird of prey as shown by the claw marks on it. A week later, we had occasion to examine a hole in an old apple tree occupied by a screech owl (*Scops asio*). Besides specimens of the mole (*Scalops aquaticus*), and meadow mice (*Arvicola riparius*), we found four pine mice, two of which were uninjured. The only other specimen noted was shot March 3d, while running on top of the snow.—*A. K. Fisher, M. D., Sing Sing, New York.*

A NEW GENUS AND SPECIES OF SHREW.—In the Transactions of the Linnæan Society of New York, Dr. C. Hart Merriam describes and figures a shrew of more than ordinary interest captured by Captain Bendire near Fort Klamath. It is one of the largest of the shrews, is the type of a new genus, and is called *Atophyrax bendirii*. Bendire's shrew differs from all existing genera in external, cranial and dental characters. It has affinities with both Sorex and Neosorex, and is in some respects intermediate between them, though in some respects it passes Neosorex in the direction away from Sorex. It also possesses characters of its own not found in either of these genera. Dr. Merriam thinks that it in common with Neosorex was early differentiated from a group of thirty-two toothed shrews of which the genus Sorex contains the near-living allies. "Having abandoned a fossorial for, in the one case a natatory, in the other a paludal habit, Neosorex and Atophyrax doubtless began to diverge in the same direction, their distinctive features having been developed and intensified as their peculiarities of habit became fixed—each retaining in different degrees of modification certain characteristics of the original stock."

HARELDA GLACIALIS AT NEW ORLEANS.—An old male in winter plumage was shot on Lake Catherine, a salt water bay a short distance from the city, on Feb. 28th, 1885. Andubon says that this duck comes down as far south as this latitude, but it is the first specimen I have seen shot in this neighborhood.

The skin of this bird is in my possession.—*G. Kohn, 14 Carondelet St., New Orleans.*

ORIGIN OF THE AMERICAN VARIETIES OF THE DOG.—The impression that the domestic dog of the old world has descended from wild species distinct from the wolf may be well founded, but in America the evidence tends to prove that the Eskimo, and other

[1] Quadrupeds of North America, Vol. II, 1851, p. 219.

domestic varieties of dogs were domesticated by the aborigines and used by them long anterior to the discovery of the continent by the Europeans, the varieties in question originating from the gray wolf or prairie wolf. First as to the Eskimo dog. From the following extract from Frobisher it appears evident that the Eskimo had the present breed of domestic dogs long anterior to the year 1577. Frobisher's account of the Eskimo themselves is, so far as we know, the first extant, and is full and characteristic. After describing the natives he goes on to say: "They frank or keepe certaine dogs not much much vnlike wolues, which they yoke togither, as we do oxen and horses, to a sled or traile: and so carry their necessaries over the yce and snow from place to place: as the captive, whom we haue, made perfect signes. And when those dogs are not apt for the same vse: or when with hunger they are constrained for lack of other vituals, they eate them: so that they are as needful for them in respect of their bignesse, as our oxen are for vs." [1]

Regarding the Eskimo dog, Richardson remarks in his Fauna Boreali-Americana, p. 75: "The great resemblance which the domestic dogs of the aboriginal tribes of America bear to the wolves of the same country, was remarked by the earliest settlers from Europe (Smith's Virginia), and has induced some naturalists of much observation to consider them to be nearly half-tamed wolves (Kalm). Without entering at all into the question of the origin of the domestic dog, I may state that the resemblance between the wolves and the dogs of those Indian nations, who still preserve their ancient mode of life, continues to be very remarkable, and it is nowhere more so, than at the very northern extremity of the continent, the Esquimaux dogs being not only extremely like the gray wolves of the Arctic circle, in form and color, but also nearly equaling them in size. The dog has generally a shorter tail than the wolf, and carries it more frequently curled over the hip, but the latter practice is not totally unknown to the wolf. * * * I have, however, seen a family of wolves playing together, occasionally carry their tail curled upwards."

The Hare Indian dog is also supposed to be a domesticated race of the prairie dog, as shown by the following extract from Richardson's Fauna Boreali-Americana:

"*Canis familiaris* var. *B. lagopus*, Hare Indian dog. This variety of dog is cultivated at present, so far as I know, only by the Hare Indians and other tribes that frequent the border of Great Bear lake and the banks of the Mackenzie. It is used by them solely in the chase, being too small to be useful as a beast of burden or draught." It is smaller than the prairie wolf. "On comparing live specimens I could detect no marked difference in form (except the smallness of its cranium), nor in fineness of the fur,

[1] The second voyage of Master Martin Frobisher, 1577. Written by Master Dionise Settle, Hakluyt, Vol. III, new edition, London, 1810, p. 62.

and arrangement of its spots of color. * * * It, in fact, bears the same relation to the prairie wolf that the Esquimaux dog does to the great gray wolf."

Another variety of Indian dog is Richardson's *Canis familiaris* var. *D. novæcaledoniæ*, Carrier Indian dog. The Attnah or Carrier Indians of New Caledonia possess a variety of dog which differs from the other northern races. "It was the size of a large turnspit dog and had somewhat of the same form of body; but it had straight legs, and its erect ears gave it a different physiognomy."

The spitz dog, Mr. J. A. Allen informs us, is with little doubt a domesticated subarctic variety of the prairie wolf.

Sir John Richardson in the Appendix to Back's Narrative, Paris, 1836, p. 256, remarks: "Indeed, the wolves and the domestic dogs of the fur countries are so like each other, that it is not easy to distinguish them at a small distance; the want of strength and courage of the former being the principal difference. The offspring of the wolf and Indian dog are prolific, and are prized by the voyagers as beasts of draught, being stronger than the ordinary dog."

The origin of the ordinary Indian dog of North America is obscure, but Richardson, who names it *Canis familiaris* var. *C. canadensis*, North American dog, throws much light on its origin:

"By the above title I wish to designate the kind of dog which is most generally cultivated by the native tribes of Canada, and the Hudson Bay countries. It is intermediate in size and form between the two preceding varieties, and by those who consider the domestic races of dog to be derived from wild animals, this might be termed the offspring of a cross between the prairie and gray wolves. * * * The fur of the North American dog is similar to that of the Eskimaux breed, and of the wolves. The prevailing colors are black and gray, mixed with white. Some of them are entirely black. * * *" He quotes from Theodat's "Canada," written in 1630, to show that of the early period, and "perhaps even before the arrival of Europeans, they formed an esteemed article of food of the natives." Confirmatory of the theory of the Pre-columbian origin of the Indian dog may be cited the following entract from Hakluyt's Voyages regarding the Indian dogs seen on Cape Breton island, p. 1593:

"Here divers of our men went on land upon the very cape, where, at their arivall they found the spittes of Oke of the savages which had roasted meate a little before. And as they viewed the countrey they sawe divers beastes and foules, as blacke foxes, deere, otters, great foules with red legges, pengwyns, and certain others. * * * Thereupon nine or tenne of his fellows running right vp over the bushes with great agilitie and swiftness came towards vs with white staues in their hands like halfe pikes, and their dogges of colour blacke not so bigge as a grayhounde

followed them at the heeles ; but wee retired vnto our boate without any hurt at all received." (The voyage of the ship called the *Marigold* of M. Hill of Redrise vnto Cape Breton and beyond to the latitude of 44 degrees and an half, 1593, written by Richard Fisher Master Hilles man of Redriffe. Hacluyt, III, 239.)

It is probably this variety, the bones of which have been found by Dr. J. Wyman, in the shell heaps of Casco bay, Maine.

"The presence of the bones of the *dog* might be accounted for on the score of its being a domesticated animal, but the fact that they were not only found mingled with those of the edible kinds, but like them were broken up, suggests the probability of their having been used as food. We have not seen it mentioned, however, by any of the earlier writers, that such was the case along the coast, though it appears to have been otherwise with regard to some of the interior tribes, as the Hurons. With them, game being scarce, "venison was a luxury found only at feasts, and dog flesh was in high esteem." * * * A whole left half of the lower jaw of a *wolf* was found at Mount Desert, measuring 7.5 inches in length, making a strong contrast in size with a similar half from a dog found at Crouch's cove. This was more curved, and had a length of a little less than five inches." (AMER. NAT., I, 576, Jan. 1868.)

It is possible that the Newfoundland dog was indigenous on that island, and also an offshoot of the gray wolf, allied to the Eskimo. In their "Newfoundland," Messrs Hatton and Harvey say that there are few fine specimens of the world-renowned "Newfoundland dog" to be met with now in the island from which it derived its name. "The origin of this fine breed is lost in obscurity. It is doubtful whether the aborigines possessed the dog at all ; and it is highly improbable that the Newfoundland dog is indigenous. Some happy crossing of breeds may have produced it here. The old settlers say that the ancient genuine breed consisted of a dog about twenty-six inches high, with black ticked body, gray muzzle, and gray or white stockinged legs, with deer claws behind." Judicious treatment has greatly improved the breed. "Their color is white with black patches, curly coats, noble heads and powerful frames. The favorite Newfoundland dog at present is entirely black, of large size, from twenty-six to thirty inches in height, remarkable for his majestic appearance. It is now generally admitted that there are two distinct types of the Newfoundland dog, one considerably larger than the other, and reckoned as the true breed; the other being named the Labrador, or St. John's, or Lesser Newfoundland. The latter is chiefly found in Labrador, and specimens are also to be met with in Newfoundland," pp. 194–195.

Regarding the dogs of the Mexican Indians, Nadaillac says in his Prehistoric America: "The European dog, our faithful com-

panion, also appears to have been a stranger to them.[1] His place was very inadequately filled by the coyote,[2] or prairie wolf, which they kept in captivity and had succeeded in taming to a certain extent."

In a recent visit to Mexico, not only along the railroads, but in the course of a stage ride of about five hundred miles through provincial Mexico, from Saltillo to San Miguel, we were struck by the resemblance of the dogs to the coyote; there can be little doubt but that they are the descendants of a race which sprang from the partly tamed coyote of the ancient Mexican Indians. At one village, Montezuma, we saw a hairless or Carib dog as we supposed it to be; similar dogs are sometimes seen in the United States.

Finally that the domestic dog and gray as well as the prairie wolf will hybridize has been well established.

Dr. Coues has observed hybrids between the coyote and domestic dog on the Upper Missouri (see the AMERICAN NATURALIST, 1873, p. 385). To this we may add our own observations made at Fort Claggett on the Upper Missouri in June, 1877. We then were much struck by the wolf-like appearance of the dogs about an encampment of Crow Indians, as well as the fort; they were of the size and color of the coyote, but less hairy and with a less bushy tail. They were much like those lately observed in Mexico, and I have never seen such dogs elsewhere. Their color was a whitish tawny, like that of the Eskimo dog.

Confirmatory of these observations is the following note by J. L. Wortman in the report of the Geological Survey of Indiana for 1884: "During extended travel in Western U. S. my experience has been the same as that recorded by Dr. Coues. It is by no means uncommon to find mongrel dogs among many of the Western Indian tribes, notably among Umatillas, Bannocks, Shoshones, Arrapahoes, Crows, Sioux, which to one familiar with the color, physiognomy and habits of the coyote, have every appearance of blood relationship, if not, in many cases, this animal itself in a state of semi-domestication. The free inter-breeding of these animals, with a perfectly fertile product, has been so often repeated to me by thoroughly reliable authorities and whose opportunities for observation were ample, that I feel perfectly willing to accept Dr. Coues' statement."

To these statements may be added that of Mr. Milton P.

[1] Certain kinds of dogs were, however, domesticated in America. They were called *Xulos* in Nicaragua, *Tzomes* in Yucatan, and *Techichis* in Mexico. These were considered to afford very delicate food after having been castrated and fattened.

[2] *Canis latrans* Baird. In a description of Virginia, published in 1649, we read: "The wolf of Carolina is the dog of the woods. The Indians had no other curs before the Christians came amongst them. They are made domestic. They go in great droves in the night to hunt deer, which they do as well as the best pack of hounds."

Pierce, published in *Forest and Stream* for June 25, 1885, as follows: "Hybrid wolves have always been very common along our Western frontiers. I have seen several of them, sired both by dogs and wolves, and all I have seen have resembled wolves rather than dogs." It is to be hoped that our mammalogists may collect and examine this subject, particularly the skulls and skins of numerous specimens both of dogs and wolves and of the hybrids between them. Farther observations are also needed as to the fertility of the hybrids.—*A. S. Packard.*

Zoological News.—*General.*—MM. G. Pouchet and T. de Guerne have examined the organisms taken by net in the Baltic, in 1884, by the Prince of Monaco. The region fished over extended from 54° 59′ N. lat., at 14° 48′ long. W. of Paris, to the end of the Gulf of Finland. It seems that the pelagic fauna of this gulf resembles that of the great lakes of Europe, as made known by Forel, Lilljeborg, and others. Certain species of Cladocera are very common, and, as in the lakes, are attacked by parasitic cryptogams. Numerous Infusoria and rotifers of the genus Anuræa augment the resemblance to the fauna of the Scandinavian lakes. The central basin of the Baltic offers characters transitional between those of fresh and salt water.

Sponges.—Mr. H. I. Carter (*Ann. and Mag. Nat. Hist.*, February, March and April, 1885), describes numerous new species of sponges from the neighborhood of Port Philip Heads, South Australia, and also contributes a note upon the mode of circulation in the Spongida.

Cœlenterates.—Professor Allman recently read before the Linnæan Society descriptions of thirty-eight new species of hydroids, belonging to twelve genera. The plumularian genus Podocladium is very remarkable, not only by the possession of both fixed and movable nematophores, but by the fact that every hydrocladium is supported on a cylindrical jointed peduncle. *Thuiaria heteromorpha* combines upon one hydrophyton no less than three morphological types, yet Mr. Allman regards the generic position as determined by the one which most decidedly prevails in it.

Mollusks.—M. Lacaze Duthiers has instituted a comparison between the ordinary slugs and the genus Testacella. Especially he has compared the nervous systems and traced out the homologies of the nerves. In the slug the rudimentary mantle is situated upon the back, while Testacella carries its small shell and underlying mantle on the under side of its posterior extremity, yet the innervation of these parts is the same. The Testacella is not a vegetable eater, but searches for and devours worms by following them into their holes, and M. Lacaze Duthiers believes it to be a slug gradually altered and transmitting its altered characters by heredity.——W. E. Hoyle (*Ann. and Mag. Nat. Hist.*, March,

1885) gives the diagnoses of twenty species of Cephalopoda collected during the cruise of the *Challenger*. The new kinds are *Octopus verrucasus*, the minute hectocotylus of which is present, *O. boscil*, var. *pallida*, *O. australis*, *O. hongkongensis* *O. tonganus*, hectocotylus present, *O. vitiensis*, *O. duplex*, and four other species of Octopus besides *O. januarii*, Steenstrup M. S.; *Eledone rotunda* and *E. brevis*, *Japatella* (nov. gen.) *prismatica* and *diaphana*; *Cirrolentha magna*, *meangensis*, and *pacifica*, and *Amphobrebus pelagicus*, nov. gen. et sp.——Mr. A. H. Cooke republishes, with additions and corrections, a list of the testaceous mollusks obtained by R. MacAndrew in the Gulf of Suez. Of nineteen species of Cypræa found, nine occur at the Sandwich islands, six in Japan, eight in Australia and five at Natal, and of seven species of Triton two are common to the Sandwich islands, two to Japan and one to Australia.

Crustacea.—E. J. Miers (*Ann. and Mag. Nat. Hist.*, January, 1885) gives a synopsis of the species of Micippa and Paramicippa. He allows six species of the former genus (*M. cristata*, *mascarenica*, *philyra*, *spinosa*, *curtispina*, and *thalia*), all of which seem to be restricted to the shallower waters of the Indo-Pacific, and only by one species of the latter genus (*P. tuberculosa*).——In the same issue of the same periodical the Rev. Thomas R. R. Stebbing describes *Cyproidia damnoniensis*, a new English amphipod. ——M. W. Czerniawsky has published at Kharkoff a work on the littoral decapodous Crustacea of the Black sea. The number of Pontic decapods has been increased by twenty, thus reaching forty-eight species. The author arrrives at some interesting conclusions as to genealogy. The nine different stages of the metamorphosis of Carcinus are, he says, a repetition of its genealogy; all three species of Astacus found in the Ponto-caspian fauna are maritime forms which have immigrated into sweet water, and even *Astacus pachypus* of the mountain lake Abrau is the remainder of a maritime fauna, so also Thelphusa, which has gigantic representatives in the South Caspian. *Eriphia spinifrons* and *Carcinas mœnas* reach a very large size on the shores of the Crimea and at Odessa. While most crabs reach their fullest development only in very salt and warm water, others reach the same size under reverse conditions. The decapods of the Sea of Azov have not yet been explored.

Fishes.—Professor Fritsch has been induced by the examination of the peculiar flap-like appendages of Lophius to search for corresponding peculiarities in the nervous system, peculiarities which he soon discovered in the medulla oblongata. On the posterior side of the medulla, quite superficially situated, he found a group of huge ganglion-cells, such as had hitherto only been found in Malapterurus. While the latter fish had but two such cells, Lophius had a larger number.

Reptiles and Batrachians.—G. A. Boulenger gives a list of thirty-one reptiles and sixteen batrachians from the province of Rio Grande do Sul, Brazil, collected by Dr. H. von Ihering. The new species are *Enyalius iheringii*, and *Liolæmus occipitalis* (Lacertilia), and *Coronetta iheringii*.

EMBRYOLOGY.[1]

ON THE AVAILABILITY OF EMBRYOLOGICAL CHARACTERS IN THE CLASSIFICATION OF THE CHORDATA [*concluded*].—1. The lowest major subdivision of the Endocyemate subphylum embraces forms in which the ovum is invested by a zona radiata, external to which comes an additional investment of albuminous matter secreted by the oviduct, this albuminous envelope being usually in turn covered by a fibrous membrane immediately overlaid by a porous, more or less calcareous shell, also secreted by the oviduct. Chalazæ are often developed. The cleavage is partial, the germinal matter, as a rule, forms but an insignificant part of the whole ovum, and is aggregated at one pole of the latter as a blastodisk. The blastodermic vesicle is developed from the blastodisk by epiboly upon the vitelline mass, which is finally included so as to occupy a ventral position in the vesicle. Development is at most viviparous only during the very earliest stages or while the ovum is passing through the oviducts, or more or less entirely oviparous, or quite ovoviparous. The allantois is greatly developed, but never associated in the development of a true placenta, though it is usually respiratory in function.

Under this definition the three following groups seem to be appropriately included:

a. Ova buried in the earth or sand by the parent, and left to be incubated by the heat of the sun. Some species ovoviviparous. Reptilia.

b. Ova incubated by the parent in a nest specially constructed for the purpose. Aves.

c. Ova incubated by parent in an abdominal marsupium or in a nest at the end of a burrow. Recently hatched young nourished by the parent for a time upon milk secreted by mammary glands. No functional uterus. Ornithodelphia.

It may also be noted that with group *b* the distinctly warm-blooded series of the Chordata begins. The relatively high temp rature of the body of the adult plays an important part in incub[e]tion or in accelerating metabolism in the embryo. The prec[a]ding three groups, on account of the many features of resemb[e]ance and reptilian traits possessed in common (group *c* being alparently affiliated with the extinct Theromorpha of Cope), mpght be considered to form a series to be called Paratheria.

12. The highest major subdivision of the Endocyemate sub-

[1] Edited by JOHN A RYDER, Smithsonian Institution, Washington, D. C.

phylum embraces the eutherian type, or the viviparous Mammalia, in which the ovum is invested only by a zona radiata. The ovum also becomes more or less covered over by reflections of the uterine epithelium, or processes from the surface of the ovum are received into furrows or pits of the mucous surface of the uterine cavity, in which embryonic development proceeds more or less nearly to completion, and where the developing embryo acquires nourishment after the manner of a parasitic organism. The cleavage of the egg is total, and leads to the formation of a hollow, rapidly-enlarging, blastodermic vesicle or blastula, in which no vitelline matter or deutoplasm lies free in the ventral pole or yolk sack. This group is characterized by its viviparity, the development of a placenta and the possession of a functional uterus; it has obviously descended from one of the preceding groups which had ova provided with a large yolk, the yolk having gradually atrophied or failed to develop as the peculiar viviparous mode of development became more and more pronounced.

a. The lowest division of the Eutheria would be separated from the highest, on embryological grounds, by the circumstance that the vascular system of the fœtus is brought into relation with the maternal vessels by means of the vessels of the yolk sack (Owen, Osborn). Or by means of pseudopodal processes of the cells forming the yolk sack, Phascolarctos (Caldwell). Allantois more or less rudimentary. Didelphia.

b. In the highest division of the Eutheria the vascular system of the fœtus is brought into relation with the maternal vessels by means of the allantois, which is concerned in forming a villous or spongy vascular mass known as the placenta. Monodelphia.

In the present state of our knowledge it seems premature to attempt a definition of the orders of the Monodelphia upon the basis of placental characters alone, as the following scheme seems to show. It is difficult, however, not to believe that the non-deciduate and diffuse type of placenta is the most primitive, and that then follows the deciduate zonary, and finally as the most specialized the deciduate discoidal. This seems to me must have been the order of evolution of the forms of the placenta, for the reason that in the Paratherian, Endocyemate form, from which the Eutheria have undoubtedly been developed, the vascular allantois invests the whole embryo. In this succession the orders of the Monodelphia will therefore be here arranged as nearly as possible:

aa. Placenta non-deciduate, diffuse or cotyledonary. Cetacea, Sirenia, Ungulata.

bb. Placenta non-deciduate, diffuse (Manis); or non-deciduate? nearly zonary (Orycteropus); or non-deciduate, zonary (Dasypus novemcinctus); or deciduate discoidal (Dasypus sp., Cholœpus). Edentata.

cc. Placenta deciduate, zonary. Carnivora, Proboscidea, Hyracoidea.

dd. Placenta deciduate, discoidal or exceptionally non-deciduate and diffuse as in the Lemuridæ. Rodentia, Insectivora, Cheiroptera, Primates.

Much remains to be learned of the earliest stages of the formation of the placenta, especially in the Primates. In Talpa, Heape has found a rudimentary "träger" or suspensor developed. In some of the Rodentia the embryonic mass is precociously invaginated into the blastocœl, and the amniotic cavity is formed in the most extraordinary manner, or by a sort of vacuolization or accumulation of fluid (liquor amnii) in the midst of the mass of undifferentiated embryonic cells. This occurs in Mus, Arvicola and Cavia, according to Selenka. In these forms the blastodermic vesicle also becomes adherent to the uterine epithelium at a very early stage, and the suspensor is very markedly developed in the three forms mentioned. The precocious invagination of the undifferentiated embryonic mass of cells into the blastocœl leads, in the Rodentia, to an apparent inversion of the embryonic layers. These forms have therefore attained the most specialized mode of development known amongst Mammalia, so that, judged by the standard of embryology alone, they would rank higher than the Primates.

The foregoing scheme illustrates in a very striking manner the way in which complication after complication has been added to the developing germ, starting with a simple blastula developed by total cleavage in Branchiostoma; the next step in the progress of embryonic specialization is that seen in the amphibian and marsipobranchian embryo, in which a distinct neurenteric canal is also developed, and in which the neurenteron is continued into the enteric cavity, which itself traverses the segmented vitelline mass longitudinally along its upper half. In the next grade of specialization, or that represented by the Ichthyes of this arrangement, the vitellus remains unsegmented for a long time, and is practically excluded from sharing in the formation of the enteric walls, but the embryo is sessile in the greater number of species embraced in this series, and while only a portion of the blastodermic area leads to the differentiation of an embryo, no part of the ectoblast is ever so folded off to form provisional organs such as the amnion and false amnion, which serve only a temporary purpose, to be finally cast off when they have subserved their function in the development of the embryo, as in the highest forms. These latter, or the endocyemate types, as a rule, develop a blastoderm with a relatively very large area, but only a very small portion of the ectoblast ever takes a permanent share in the formation of the body of the embryo, the remainder of this layer being entirely deciduous. In the Paratherian series of endocyemate types, viz., Reptilia, Aves and Ornithodelphia, there is a large yolk developed, which seems to have determined the development of the hollow yolkless blastophere of the Eutheria, in which, how-

ever, there is a manifest tendency for that structure to increase rapidly in size owing to the imbibition of fluid with which the blastocœl becomes more and more distended, this increase in size at the same time being aided by the division of the cells entering into the formation of the walls of the blastocœl. The greater part of the walls of this vesicle are finally metamorphosed by a process of folding off and ingrowth of the embryo into the vesicle by invagination, into a respiratory apparatus and secondary system of envelopes, a portion of which also takes part more or less extensively in the absorption of pabulum from the surrounding uterine surfaces which may be more or less completely reflected around the embryo and its vesicle, to be finally cast off at birth together with those parts of the vesicle derived from the ectoblast, which are also deciduous. The vesicle also tends, with a few exceptions, to thrust out hollow villi, which dip into pits in the uterine mucosa. These may arise locally or all over the vesicle, and reach their fullest development when the chorion has been formed, when the greater part of the surface of the vesicle acquires a shaggy covering of villi, into which vascular loops from the allantois are insinuated, over a restricted area internally or over its whole surface. These then become more or less completely insinuated into vascular uterine crypts into the constitution of which a decidua may or may not enter.

It will, I think, be obvious to any one, that if an oviparous paratherian form were to have the eggs which it produces so modified as to lose the shell, yolk and albuminous and fibrous envelopes, leaving only the naked endocyemate ovum to be retained near the outlet of the oviduct, the wall of which would then become thickened so as to form a specialized uterine dilatation, the conditions for a realization of the eutherian mode of viviparous development would be present. In this way, no doubt, the peculiarly specialized mode of mammalian development arose.

Objections may be urged against the position I have assigned to the Amphibia and Marsipobranchii as well as to the names given to the groups, and to the stress laid upon the physiological aspects of development and their importance not only in taxonomy but also in tracing the mode of the evolution of particular grades of development.

The form of the placenta seems to depend upon several factors: (1) The early or late attachment of the blastodermic vesicle to the uterine walls; (2) the early or late invagination of the embryo or embryonic mass; (3) the extent of subzonal membrane covered by the allantois, and the mode in which the latter is extended; (4) the form of the uterine cavity in which the blastodermic vesicle is lodged, whether tubular, bicorned or irregular; (5) the position and disposition of the uterine mucosa which is brought into relation with the placenta, whether it lines the conical or tubular

cornua, sides or fundus of the uterus; (6) the disposition of the crypts, fossæ, pits or folds of the uterine mucosa; (7) the arrangement and disposition of uterine vessels from which the maternal tufts or villi are fed and derived. These influences are largely mechanical in character, and like the influence exerted by the vitellus, lead, in certain cases, to very remarkable modifications of embryonic development.

The foregoing scheme deals more especially with the evolution of the various higher types of development, and if the way in which these have grown out of the lower ones has been made a little less obscure than hitherto, my object in writing this will have been attained. The manner in which placentation has been modified is also a fruitful subject for farther investigation, not less so, in fact, than the question as to how the amnion arose. The facts of embryology tend to show that the amnion is the result, as stated above, of the gradual invagination of the embryo into the blastodermic vesicle. The invagination begins at the head end of the embryo; the amnion, as is well known, always developing its first traces at the cephalic end of the embryonic disk. It is also probable that the cavity of the false amnion is the homologue of the cleavage cavity of certain of the lower forms.— *John A. Ryder.*

PHYSIOLOGY.[1]

A Contribution to the Knowledge of Pepsin[2].—Sundberg has hit upon a method for preparing pepsin, which gives results better than those obtained by Brücke's method.

Calves' stomachs are taken, the pyloric portion removedand the remainder of the mucous membrane carefully washed with water. The superficial portion of the membrane is then scraped off with a watch glass, and the substance thus obtained is ground up with a weighed quantity of salt. Enough water is added to this to make a saturated solution of salt. After standing 24–72 hours this was filtered and the Na Cl removed by dialysis. The dialysed liquid contained very little albumin and had a very powerful peptic action. It was further purified by being kept at 40° C. for some time to destroy the rennet ferment, and was then allowed to digest itself for one or two weeks, until all the albumin was converted into peptone. To this liquid chloride of calcium and acid sodium phosphate were added, and the liquid made weakly alkaline by ammonia; the resulting precipitate of calcium phosphate carried down the pepsin with it. The precipitate was collected in a filter, thoroughly washed with water and dissolved in as small a quantity as possible of five per cent HCl. This solution was then thoroughly dialysed. The liquor obtained finally, when brought to the proper degree of acidity, digested very ac-

[1] This department is edited by Professor Henry Sewall, of Ann Arbor, Mich.
[2] Zeitsch. f. physiol. Chemis. 9, 319. Sundberg.

tively. With tannic acid, mercuric chloride, iodine, platinum chloride, and lead acetate it gave no albumin reaction whatever. The only reagent that affected it was absolute alcohol. When the pepsin solution was added to five or six times its volume of alcohol a slight white precipitate occurred. This, when burnt on platinum foil, gave the well known odor of burning nitrogenous matter. The author concludes, that while pepsin is a nitrogenous body, it is not albuminous.

CONTRIBUTION TO THE KNOWLEDGE OF BILE CAPILLARIES[1].—Miura has discovered a modification of the gold method by which the bile capillaries can be stained, giving a simpler means for their study than the method of artificial injection usually employed. Pieces of liver kept in Müller's liquid for two to five days are washed in water for several hours, and then transferred to a fifteen per cent solution of glucose for 2–3 hours. They are then placed in a 0.1 to 0.2 per cent solution of the double chloride of gold and sodium for two or three days, and again placed in the glucose solution and allowed to reduce for two or three days. Sections are cut by means of a freezing microtome.

Miura has endeavored to settle two questions by this method. 1. Do the Kupffer vacuoles really exist in the liver cells as the beginning of the bile capillaries? His method gives no indication at all of these vacuoles, and he infers that, as usually found, they are artificial products caused by the pressure used in injection. 2. Have the bile capillaries walls? When their sections were traced out he quite frequently found places in which the broken ends of the capillaries projected beyond the cells, or where they formed a bridge passing between two cells at a point where they had been separated by the tracing needle. He concludes from these appearances that the capillaries have walls of their own.

THE MICROSCOPIC APPEARANCE OF STRIPED MUSCLE DURING CONTRACTION[2].—The author investigated the muscle when thrown into maximal tetanus, and when the tetanus was not maximal. The muscle was stimulated by induction shocks and killed during contraction by osmic acid or alcohol.

The muscle of maximal tetanus when thus treated showed certain bands (contraction bands) running across the fibers, representing, doubtless, Krause's membrane of the resting muscle. Between these contraction bands the fiber was swollen out, giving a convex border. Examined by polarized light, the whole substance of the fiber is found to be doubly refracting. The contraction band representing Krause's membrane undergoes no change during contraction; it appears, in the author's opinion, to play the passive part of giving a fixed support from the shortening. The portions in between the contraction bands, also doubly refracting,

[1] Virchow's Archiv., 99–512. Dr. Miura.
[2] Du Bois Reymond Archiv., 1885. S. 150. Dr. Nickolaides.

represent the dim bands of the resting muscle, while the singly refracting light bands of the resting muscle disappear completely during maximal tetanus, being absorbed apparently by the doubly refracting substance of the dim band. When the tetanus was not maximal some of the singly refracting substance was still found in the contracted fiber.

The results given go to support Englemann's theory of muscle contraction, according to which the shortening of the contracted fiber is owing to the absorption by imbibition of the singly refracting substance of certain ultimate elements in the doubly refracting substance, thus becoming spherical during the act and decreasing in diameter.

PSYCHOLOGY.

DO MONKEYS INVARIABLY LEARN by EXPERIENCE?—Some time ago I read a statement to the effect that monkeys were unable to learn by experience, a particular in which they were said to differ from cats. The experiment suggested was to show the animal its reflection in a mirror, and after a time to repeat the process and observe whether it would be deceived a second time. I have never had the opportunity to try the experiment on monkeys, though I am told, on tolerably good authority, that a monkey can never satisfy itself that there is not another monkey behind the glass. But my acquaintance with cats is somewhat larger, and I find that, after once thoroughly investigating the subject, a cat which has reached an age of discretion takes no further interest in its own reflection. The question in my mind is: if a monkey cannot learn by experience, how can it learn? for it seems to me that almost every means of learning can be reduced to some form of experience, or to something that is practically the same thing.—*W. H. Frost, Brown University.*

A DOG'S STRATEGY.—Our little farm dog "Trip" is of mongrel descent, yet he has more than an ordinary amount of "gray matter" in his brains. He is very sagacious and knowing, and only seems to lack the power of speech to show that sensible ideas run through his head. He likes to leap from a stump into my arms as I am on horseback, and go off with me at a full gallop. One day a lot of pigs got out of their enclosure through a little hole at the apex of an acute angle, or corner, of the fence. This angle widened into the garden where the pigs were not tolerated. As soon as "Trip" saw them he went after them to get them out. They fled before him into this angle and began, slowly, of course, to make their way through. As soon as he saw them all within the angle, he stopped before its widest opening—the base—and intently watching, waited until the last one had crawled back into its proper enclosure. He seemed to understand that if he made a dash at them they would turn around and rush back into

the garden. As soon as they were all in he looked up with a proud and pleased expression, as much as to say: "Isn't that a clever piece of strategy?" We all thought it was. But in numberless incidents of a similar nature "Trip" has proved himself to be a dog of excellent sense and judgment—and often of "rare executive ability."—*Charles Aldrich, Webster City, Iowa, July 11, 1885.*

DO THE LOWER ANIMALS SUFFER PAIN?—As bearing on this question so often asked, we may quote the following statements from Romanes' "Jelly-Fish, Star-Fish and Sea-Urchins": Before any rational scruples can arise with regard to the vivisection of a living organism, some reasonable ground must be shown for supposing that the organism, besides being living, is also capable of suffering. But no such reasonable ground can be shown in the case of these low animals. We only know of such capability in any case through the analogy based upon our own experience, and, if we trust to this analogy, we must conclude that the capability in question vanishes long before we come to animals so low in the scale as the jelly-fish or star-fish. For within the limits of our own organism we have direct evidence that the nervous mechanisms, much more highly elaborated than any of those which we are about to consider, are incapable of suffering. Thus, for instance, when the nervous continuity of the spinal cord is interrupted, so that a stimulus applied to the lower extremities is unable to pass upwards to the brain, the feet will be actively drawn away from a source of irritation without the man being conscious of any pain; the lower nervous centers in the spinal cord respond to the stimulation, but they do so without *feeling* the stimulus. In order to feel there must be consciousness, and, so far as our evidence goes, it appears that consciousness only arises when a nerve-center attains to some such degree of complexity and elaboration as is to be met with in the brain. Whether or not there is a dawning consciousness in any nerve-centers considerably lower in the scale of nervous evolution, is a question which we cannot answer; but we may be quite certain that, if such is the case, the consciousness which is present must be of a commensurately dim and unsuffering kind. Consequently, even on this positive aspect of the question, we may be quite sure that by the time we come to the jelly-fish—where the object of the experiments in the first instance was to obtain evidence of the very existence of nerve-tissue—all questions of pain must have vanished. Whatever opinions, therefore, we may severally entertain on the vexed question of vivisection as a whole, and with whatever feelings we may regard the "blind fury" who, in the person of the modern physiologist, "comes with the abhorred shears and slits the thin-spun life," we should be all agreed that in the case of these animals the life is so very thin-spun that any suggestion of abhorrence is on the face of it absurd.

PSYCHICAL RESEARCH.—The Society of Psychical Research held its third general meeting April 24, in London, to hear the address of Professor Balfour Stewart, F. R. S. This society was founded by Professor Barrett, on the 5th of January, 1882, and formally constituted on the 20th of February of the same year with Professor Henry Sidgwick as president. At present the membership is 586. A kindred society has been recently started in America. Since its commencement the society has issued eight parts of proceedings, and in 1884 commenced the publication of a journal. In the autumn of 1884 a report of the Committee on Theosophical Phenomena was issued for private circulation only. A large number of slips has been printed comprising a selection of the evidence collected in the various departments of inquiry. The greatest liberality on the part of members has enabled the society to do a great deal of printing. Professor Stewart says: "To my mind the evidence already adduced is such as to render highly probable the occasional presence amongst us of something which we may call thought-transference, or more generally telepathy; but it is surely our duty as a society to continue to accumulate evidence until the existence of such a power cannot be controverted. We have not been remiss in this respect, and it will be found from the pages of our proceedings that the main strength of our society has been given to prove the existence of telepathy, in the belief that such a fact well established will not only possess an independent value of its own, but will serve as an admirable basis for further operations.

"It is no doubt quite conceivable that after a quantity of evidence on some subject has been collected the result of its discussion should prove that there is nothing in it worth inquiring into, at least nothing new. But a definite settlement even of a negative character is not without its value, and this can only be obtained as the result of an exhaustive discussion. On the other hand it is conceivable that the result of such a discussion may be the establishment of new facts eminently worthy of record, and the next generation of our society would greatly blame the present if we decline to bring together, examine, and register the cotemporaneous evidence, so as to fit it, if not for our own final discussion, at least for that of those who shall come after us."

Part VII contains the following papers:—

On the telepathic explanation of some so-called spiritualistic phenomena, by Frederick W. H. Myers.

Abstract of the president's opening address at the eleventh general meeting.

M. Richet's Recent Researches in Thought Transference, by O. J. Lodge and Alfred Lodge.

The problems of Hypnotism, by Edmund Gurney.

Part VIII contains:—

Automatic writing, by Frederick W. H. Myers.

Opening address at the thirteenth general meeting by Professor Balfour Stewart.

Notes on the evidence collected by the Society for Phantasms of the dead, by Mrs. H. Sidgwick.
Hallucinations, by Edmund Gurney.
The calculus of probabilities applied to psychical research, by F. Y. Edgeworth.

ANTHROPOLOGY.[1]

ANTHROPOLOGICAL PUBLICATIONS.—The Philosophic Grammar of American Languages as set forth by Wilhelm von Humboldt, with the translation of an unpublished memoir by him on the American verb, by Daniel G. Brinton, A.M., M.D., professor of ethnology and archæology at the American Academy of Sciences, Philadelphia. (Read before the American Philosophical Society, March 20, 1885. Philadelphia, McCalla & Stavely, pp. 50.)

The original MS. of the memoirs is in the Royal Library at Berlin, whence Dr. Brinton obtained a copy. The fundamental ideas of the Philosophical Grammar are these: "The diversity of structure in languages is the necessary condition of the evolution of the human mind." Historic grammar traces the forms of a language; comparative grammar extends the investigation over many dialects or languages; philosophic grammar analyzes the inmost nature of languages with reference to thought. It is contrary to the results of study that the monosyllabic, the holophrastic and the inflectional languages were developed one from another.

On some doubtful or intermediate Articulations; an experiment in phonetics, by Horatio Hale, Esq. London, Harrison & Sons., St. Martin's place. 1845, pp. 243. (Reprinted from Journ. Anthrop. Inst., Feb., 1885.) This essay discusses the mixing of sounds of the same character, *m, b, w; d, l, n, r,* and seeks to account for it. Three theories are proposed; careless utterance; slight anatomical modifications in the speaker; failure of the listener to catch intermediate sounds. Mr. Hale in his paper develops the latter view. There is no doubt, as we have shown in another place, that the philologist must take into consideration the ear and the eye of the receiver of language as well as the vocal organs or the pen of the author. Furthermore, it will be found that all unwritten languages are holophrastic by agglutination or by incorporation, and that monosyllabism and inflection are two effects produced by the reduction of languages to writing. In the examples cited by Mr. Hale the difficulties are remedied instantly, when the missionaries invent an alphabetic system.

American Languages and why we should study them, an address delivered before the Pennsylvania Historical Society, March 9, 1885, by Daniel G. Brinton, professor of ethnology and archæology at the Academy of Natural Sciences, Philadelphia. (Reprinted from the *Penn. Mag. of Hist. and Biog.*) Philadelphia, Lippincott, 1885, pp. 23. In this essay the author main-

[1] Edited by Professor OTIS T. MASON, National Museum, Washington, D. C.

tains that language is almost our only clue to the kinship of American tribes; it discovers the motives of the customs, laws, social life, superstitions and religions of the savages; it discloses the development of his arts; it mirrors the relations of the sexes; it discloses the Indian's psychology; it is the handmaid of historic study. Dr. Brinton closes his address with an earnest appeal for the endowment of research in this direction.

Silex Tertiaires intentionellement Taillés, by G. de Mortillet, *L'Homme*, Paris, Mai, 1885, pp. 289–299, June, 252–262. Two propositions are insisted on in this paper, to wit: The flints of Thenay were wrought by means of fire, and the being who wrought the flints of the Tortonian and the Aquitaine epoch was not man, but an intelligent animal. This animal, more intelligent than the most intelligent recent apes, could not have been man like us, for all the higher animals have been modified since the middle Tertiary. That creature was intermediate between man and ape, a *precursor* of man. M. Mortillet has always given us great pleasure by the energy of his convictions, but in this paper, as in others lately published, there is a spitefulness which mars their effect. It looks very much like dodging the issues when we follow a man like De Quatrefages to the very brink of a conclusion and then shrink back, saying, "The geologists tell us man could not have lived in that time." See also an account of new diggings at Thenay by D'Ault-Dumesnil. *Materiaux*, xix. 241.

Remarks on chipped stone implements, by F. W. Putnam. (From the Bulletin of the Essex Institute, Salem Press.) This communication, made in June 29, 1883, has just appeared, and, if it were not too late to scold, we might complain from absolute knowledge that the author has not told us all he knows about the subject. It is to be hoped that he will put the same nicety of analysis into his technical as into his archæological papers.

Ancient Pottery of the Mississippi valley, by William H. Holmes. (From the Proceedings of the Davenport Academy.) Washington, Judd & Detweiler. The splendid collection of mound-pottery at Davenport is well known. Mr. Holmes signalized three pottery areas; Upper Mississippi, Middle Mississippi, and Lower Mississippi, or Gulf. The great body of the Davenport pottery is from the middle province, and of this there are typical regions. The description of Mr. Holmes covers the finding, age, use, construction, material, color, form, finish, ornamentation. As an artist Mr. Holmes lays himself out on the form and ornamental patterns. Believing with Klemm that every art commences with a natural object, the author has worked out by means of the Davenport pottery the shapes of the vessels and the figures traced upon them.

Prehistoric Dogs, by M. Zabarowski, *Materiaux*, June, 1885, p. 263. From the commencement, or at least the middle of the Quaternary epoch, before any possible effort at domestication, the

dog possessed varieties passing irregularly with crossing of characteristics between the wolves, jackals and foxes. If it can be shown that these varieties were in part expanded over the globe before the intervention of man, it will be settled that it is vain to make the domestic dog-descent from this or that related species.

H. de Charencey. De la conjugaison dans les langues de la famille Maya Quichée. (Extraits du Muséon.) Louvain. The naturalist and the philologist in their classifications accept the same criterium of perfection, it is the principal of the *localization of functions*. The idiom which best distinguishes grammatical categories, not confounding, for example the noun with the verb, has preëminence. In the study of this subject of differentiation we have to examine a language in every particular, great progress being made in one direction, and that ofttimes from outside influences, while the greatest simplicity remains in other particulars. M. Charencey regards monosyllabism as the simplest linguistic form, while agglomeration and inflection are subsequent stages. It seems to be nearer to the truth that monosyllabism and inflection are literary effects in speech both referable to earlier forms, perhaps agglutinative. M. Charencey devotes 130 pages to the discussion of the method in which the Maya language provides for the parts of the verb as known in the French languages.

Bulletin of the Brookville Society of Natural History, No. 1, published by the society. Richmond, J. M. Coe, pp. 45. Mr. E. R. Quick describes the stone mounds on the Whitewater.

Archæological Institute of America. Sixth annual report, 1884–85, presented at the annual meeting of the council of the institute, Boston, May 9, 1885. Cambridge, John Wilson & Son, pp. 48. Among the regulations adopted October 11, 1884, some are of general interest, as for example:

1. The Archæological Institute consists of a number of affiliated societies.

3. The government of the institute shall be vested in a council annually chosen by the members of the affiliated societies. Any local archæological society consisting of not less than ten members of the institute may by vote of the council be affiliated with the institute. There are now three societies of the institute, namely, Boston, Baltimore and New York, and it is hoped by means of this multiplication of affiliated organizations, to increase the usefulness and prove the national character of the institute. Pages 27–40 are devoted mainly to an epitome of the brilliant labors of Adolf Bandelier among the Pueblos and in Mexico. The remainder of the pamphlet is given to a recital of the institute's successes at Assos and in its school of classical studies at Athens.

Notice of some recently discovered effigy mounds, by T. H. Lewis, from *Science*, No. 106, 1885. Mr. Lewis has surveyed twenty-five effigy mounds in Minnesota, one in Iowa and ninety-

six in Wisconsin. Those from Minnesota are illustrated and more fully described.

The American Antiquarian, Vol. VII, No. 3, May, 1885. This number both in its original articles, excepting Mr. Butler's, which ought never to have been written, and in its notes is far above the average. The original papers are as follows:

Stone graves—the work of the Indians, by Cyrus Thomas (third paper).
The chief god of the Algonkins in his character as a cheat and a liar, by Daniel G. Brinton.
Earth and shell mounds on the Atlantic coast of Florida, by Andrew E. Douglass.
The sacrificial stone of San Juan Teotihuacan, by Amos W. Butler.

The Khitan Languages; The Aztec and its migrations, by John Campbell, M.A., Montreal. The purpose of this paper is to connect the Aztecs of Mexico with the Khitans of ancient Syria, the salient modern piers being Japanese, Siberian, Caucasian, Basque. Laws of phonetic change in the Khitan languages, by the same.

Chief George H. M. Johnson, *Onwanonsyshon*; his life and works among the Six Nations, by Horatio Hale. (Reprint from *Mag. Am. Hist.*, Feb., 1885). With portrait, 131–142. Says Mr. Hale: "This eminent Mohawk chief did more perhaps than any other individual of our time for the elevation and advancement of his kindred of the red race."

THE FUEGIANS.—The average height of twenty men of the Tekeenika or Yaghan race, from Orange bay, was found by M. Hyades to be 1.576 meters, that of twenty females 1.478 meters, a difference of nearly ten centimeters in favor of the men. The tallest man reached 1.660 meters, and the tallest woman 1.577 meters. Although the inhabitants of this district are few in number, the size of the families seems to show that they are not diminishing. The Yaghans of the Beagle river number some 800, and have for neighbors, at the extremity of Beagle strait, the race of the *Ona*, living in the mainland of Terra del Fuego. This race is friendly with the Tekeenika, but those who were seen fled the presence of the white man. The *Ona* are, says M. Hahn, as tall as, or taller than the Patagonians. Five entire bodies (preserved in alcohol) are in the collection brought to Paris by the *Romanche*. These are publicly exhibited by casts, and a hundred casts taken from life, representing every part of the body of individuals of both sexes and all ages, are either exposed publicly, or retained as a special collection open only to naturalists and physicians. Numerous photographs taken from every point of view, some of them representing the natives engaged in the various occupations of their simple life, add value to the collection. Every female of two years of age and upward wears the *machakana*, a small triangular piece of guanaco skin, fastened around the haunches with a plaited band of whalebone fibers. Every Fuegian carries also a mantle, which is but a sim-

ple skin of otter, seal or guanaco, imperfectly serving as a protection from cold. Bracelets, necklaces of shell, etc., are also worn by the women; and the men often wear a band of feathers or down, usually of *Bernicla antarctica*. The only cutting instrument of the Fuegians is a knife of the Mytilus shell fastened to a stone handle with shreds of sealskin. The fishing lines, made of the stems of *Macrocystis pyrifera*, or of whalebone fibers, end in a running knot furnished with a hook made from a feather. Fire is obtained by striking together two pieces of pyrites, and with the spark enkindling a mixture of the down of birds and fine scrapings from Berberis or Drimys. These scrapings are used also as sponges or napkins.

MICROSCOPY.[1]

SOME HISTOLOGICAL METHODS BY DR. C. S. MINOT [*continued*]. —*Dripping apparatus for cutting under alcohol.*—We use the form constructed by Dr. W. W. Gannett, as shown in the sketch. A liter bottle is convenient in size; the height of the stand should be such as to bring the end of the dripping tube about one inch above the blade of the microtome knife, on which the alcohol is allowed to fall continuously. To regulate the flow, an eighth inch globe valve is found to be the most convenient.

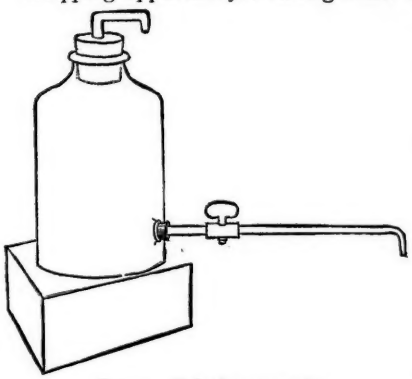

FIG. 1.—Dripping apparatus.

Benzole.—I find replaces xylol perfectly and is much cheaper.

Balsam.—Use filtered Canada balsam diluted with pure benzole.

Alcohol.—I never use absolute alcohol. I have never found any use for which alcohol of ninety-six per cent is not sufficient, and have employed it for many things successfully for which absolute alcohol was stated to be necessary.

Oil—for microtome. After many trials of various oils, we have settled on "*pure paraffine oil, specific gravity 25.*"

Paraffine.—1. Hard commercial paraffine melting at 55°–56° C.

2. Soft "chewing-gum" paraffine melting at 50°.

Twenty parts of 1 + nine parts of 2 makes a good mixture, melting about 55°, and cutting well at 20°–22° C., the ordinary winter room-temperature.

Picric Acid Carmine.—Boil one gramme best powdered carmine with 200 c.c. of water, plus an excess of picric acid, for half an

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoology, Cambridge, Mass.

hour. Allow it to stand and cool; decant the clear fluid, add fresh water, and if necessary picric acid; boil, cool and decant; repeat this operation until all the carmine is dissolved. Place the decanted fluid in an evaporating dish, add about one grain thymol and stand in a warm place until the volume is reduced to 25 c.c.; let the solution cool; filter; wash out the residue which should be on the filter with 25 c.c. water; dilute the filtrate solution with 50 c.c. water. By this means a solution ready for use, which will keep indefinitely and contains carmine and picric acid in good proportions, can be prepared with certainty.

It gives a stronger differential coloring than Ranvier's picric carmine, but overstaining must be avoided most carefully; for staining sections two to five minutes are sufficient. The fluid stains connective tissues (fibrous) deep red, striped muscle deep dull red, smooth muscle, blood and horny tissues bright yellow, glands reddish-yellow; with the kidney it gives differentiation of the different portions of the tubules; for the central nervous system it seems to be of little value. If rightly used it gives a sharp nuclear coloring.

If the aqueous solution is evaporated to dryness the residue may be redissolved in alcohol, giving an alcoholic carmine dye. This I have not yet tested sufficiently. Apparently the alcoholic solution will not keep but a few months. The alcoholic solubility of the dye offers the advantage that sections stained in the watery solution can be washed in alcohol directly.

A NEW WATER-BATH.—The following is a description of a water-bath planned by Mr. E. A. Andrews and myself, which has been in use for some time in the biological laboratory of the Johns Hopkins University.

The bath proper consists of a closed copper cylinder twenty-eight inches in diameter and eight inches deep. To the borders of holes cut in the top are soldered four round, flat-bottomed basins, eight inches in diameter and four inches deep, with a distance of two inch-

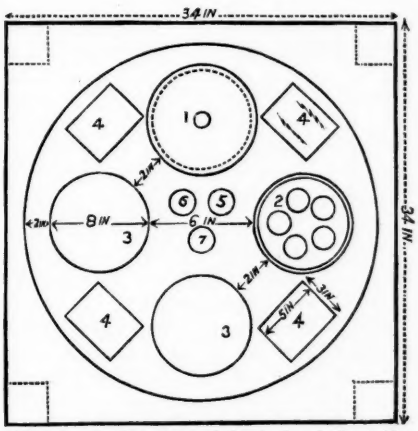

FIG. 1.—Surface view of the bath ni the table. 1, basin with lid on, 2, shelf with holes for dishes in basin; 3, open basins, 4, rectangular basins for slides; 5, tube for gas pipe; 6, hole for regulator; 7, hole for thermometer.

es between the nearest points of any two basins; and nearer the edge of the top, at the angles between the round basins, are four rectangular basins each five inches long, three and a half inches wide and two inches deep. In each of the large basins is placed, on movable supports, a shelf for the paraffine cups. This shelf is made from the circular piece of copper which was cut out of the top for the insertion of the basin. For each basin there is also a copper lid with a button handle in the center and a hole, a half inch in diameter, near this for a thermometer. When the bath is once regulated this thermometer can of course be dispensed with and the hole in the lid can be plugged up with a cork. By this arrangement the paraffine dishes are always kept dry and at a uniform temperature all over. The four rectangular basins are used for warming the slides. In each of them is a movable rack made of two tin slips, each about a half inch wide and folded as shown in Fig. 3. Each of these basins also has a copper lid with a button handle in the middle.

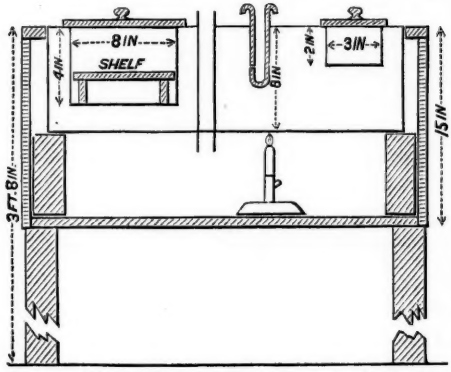

FIG. 2.—Diagrammatic section to show the depth of the bath and its basins, and its relation to the table. The legs of the table, of course, extend from the top of the box, not from the lower shelf of the table, as indicated above, and they are at the corners of the table.

FIG. 3.—Supports for slides in rectangular basins.

Near the center of the bath a tube one inch in diameter passes from the top down to and through the bottom. This tube is the passage way for the glass tube that connects the burner under the bath with the gas jet above the center of the bath, and it should be soldered to the upper side as well as to the under side of the bottom of the bath. Near this tube are two others, each one inch in diameter, that project about one and a half inches above the upper surface of the bath, but are soldered with their lower ends flush with the under side of the top of the bath. One of these tubes is for the automatic regulator, and the other is for the thermometer. Through them the water is put in or taken out of the bath. The thermometer and regulator are each in a test tube with holes blown in the sides, about one and a half inches from the bottom, and with a good flange on the upper edge by

which it is supported on the copper tube. A bit of cotton in the bottom of the test tube protects the mercury bulb of the regulator or thermometer from any jars against the hard test tube. The holes in the sides of the test tube allow the water of the bath to come in direct contact with the mercury bulbs and at the same time they are up high enough to keep the mercury from running into the bath should either of the mercury bulbs break while in the tube. The copper bath is supported in a square box-table, the top of the bath being flush with that of the table.

This table essentially is a box on four legs, with a hole in the top slightly more than twenty-eight inches in diameter, and with a door at one end. The bath is supported on four props that rest on the lower shelf of the table, and around the inside of the table is a lining of common tin to protect against possible accident. By this means a steady flame is obtained and the loss of heat is reduced to a minimum. And by grouping the regulator, thermometor and gas pipe near the center of the bath, hindrances are practically done away with. There is also connected with the gas jet a small home-made glass Bunsen burner that is attached to the glass gas tube a little above the bath. It is very convenient for warming dip tubes, lifters, etc. In so large a bath as this two flames are required, but both are burned very low. The one burner is connected directly with the gas jet and the other by way of the regulator. After the bath has, so to speak, been once set it runs on uniformly and requires no attention. It is regulated by putting a thermometer through the hole in one of the lids into the dry chamber and shutting off the regulator burner when the chamber is warm enough. The temperature, as indicated by the thermometer that dips into the water, is always a few degrees higher than that of the dry chambers. When the thermometer in the water indicates a temperature of 60° C. the basins are warm enough to keep the hardest grade of paraffine melted. The whole stands at a convenient working height, about three feet eight inches, and is very satisfactory.—*Henry F. Nachtrieb, Fellow Johns Hopkins University.*

Suggestions as to the Preparation and Use of Series of Sections in Zootomical Instruction.—It is convenient to have in the laboratory prepared series of certain types, so that the student may supplement the information he has acquired from dissection by the study of these. Thus entire series of Limax and Cyclas and partial series of the earthworm and leech are almost indispensible for an accurate knowledge of the anatomy of these forms.

Slides 2′ × 3′ (*i. e.*, double the ordinary width instead of double the ordinary length) are most convenient for small stages, and fit into many forms of slide-cabinets. Mica covers may be cut for these, and have the advantage of cheapness.

Czokor's alum-cochineal (Arch. mik. Anat. xviii, 412) is an

exceedingly convenient stain for such purposes, as it penetrates an object of considerable size readily, and differentiates admirably. Thus a Limax may be left in the fluid twenty-four hours, afterward washed in water and the excess of coloring matter removed by seventy per cent alcohol before it is transferred to stronger alcohol. Sections of tissues stain in the fluid in from two to three minutes to two to three hours, according to the method of hardening that has been adopted.

The fluid is prepared as follows: Rub up seven grammes of cochineal with an equal quantity of burnt alum in a mortar, add 700 c.c. of water, and boil down to 400 c.c. Add a trace of carbolic acid, and filter.

Bismarck brown in concentrated solution in water or seventy per cent alcohol also stains well *in toto;* there is no danger of over-staining, as the excess of color is removed by alcohol. It is particularly to be recommended where cartilaginous parts are to be studied, or where the sections are to be photographed. [The use of plates in which the sensitized surface is impregnated with a weak solution of eosin (Jour. Roy. Mic. Soc., Dec., 1884, p. 969) is said to obviate the necessity of using special stains for photographic purposes.]

Schällibaum's collodion and clove-oil mixture (one volume of the former to three of the latter) is excellent for sticking the sections to the slide. Although it is possible by this method to stain the sections on the slide in either watery or alcoholic media, much time is saved, and on the whole more satisfactory results obtained by staining the objects previously *in toto.* The collodion medium stains slightly in aniline colors, if staining on the slide be resorted to.

The study of a slide containing a large number of sections may, in certain cases, be much facilitated by having a photograph of the slide enlarged two or three times by means of an ordinary view lens. Such an enlargement is frequently sufficient to indicate where an organ appears or disappears in a series, and thus to save time in the study of the individual sections.—*Professor R. Ramsay Wright, Toronto.*

A CHEAP BELL-GLASS FOR THE LABORATORY TABLE.—Taking a plain glass finger-bowl four or five inches wide and about two inches deep, a handle may be prepared by gluing a three-quarter inch cork to the bottom. Cut off the smaller end of the cork smoothly and cover it with marine glue. If the end of the cork is now heated over a spirit lamp until the glue takes fire, and the cork is quickly pressed with its glue-covered end upon the center of the bottom of the dish, you have a cork handle by which you can lift the dish.—*J. A. Ryder.*

A SIMPLE METHOD OF INJECTING THE ARTERIES AND VEINS IN SMALL ANIMALS.—The principle involved in this method is that

by the use of two injecting fluids, of different densities, one passing through the capillaries, the other arrested at the capillaries, the whole vascular system may be injected from the aortic arch.

The application of the principle is as follows: (1) The animal is immersed in tepid water and the heart is uncovered. (2) The apex of the single ventricle, in the case of an amphibian, or of the left ventricle in the case of higher animals is then laid widely open and the blood allowed to flow freely from the auriculo-ventricular aperture (see *p* in the figure). (3) A cannula is then inserted a short distance into the arterial bulb and the first ligature is fastened around the nozzle. The second ligature is then made ready around the base of the ventricle, thus surrounding the auriculo-ventricular apertures. (4) An ordinary gelatine injecting mass, stained deep red or purple, is in the meantime prepared.

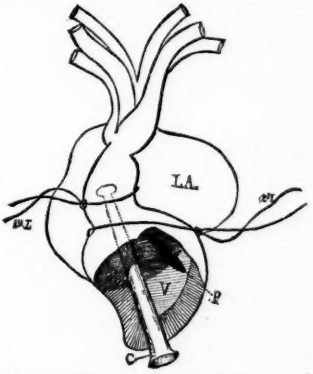

FIG. 1.—Illustrating method of preparing the frog's heart. *V*, ventricle; *LA*, left auricle; *p*, auriculo-ventricular opening; *1st L* and *2d L*, first and second ligatures; *C*, cannula.

When the body is thoroughly warmed, this mass is slowly injected. As the second ligature is still loose, a quantity of blood gradually followed by the gelatine issues from the auriculo-ventricular opening. (5) When the gelatine begins to run pretty clear, the second ligature is fastened and the syringe containing gelatine is replaced by another containing a red plaster-of-paris injecting mass. The latter drives the gelatine contained in the arteries before it as far as the capillaries, thus completely filling the venous system. When the gelatine is thoroughly cooled the animal is ready for dissection.

This method can be applied with considerable ease to all the smaller animals, such as frogs, lizards and pigeons, in preparation for class-work or investigation. Its advantages are numerous. Among its disadvantages may be mentioned the fact that alcohol cannot well be used as a preservative, because it dehydrates the gelatine, causing it to shrink and break up the veins. This difficulty is entirely obviated, however, by the use of Wickersheimer's fluid, in which the injection remains perfect for an indefinite time.—*Henry F. Osborn.*

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SCIENTIFIC NEWS.

—The Washburn Biological Survey of Kansas, says the Kansas City *Review*, has for its object "to investigate the fauna

and flora of a State which, together with Indian territory, holds the key to a more definite knowledge of the inter-relationship of four great faunal regions."

To the list of Kansas mammals as given by Professor M. V. B. Knox, some years ago, the survey has been able to add a number of species, among the most interesting of which, as considerably extending the known geographical distribution of the species, are the Mexican badger, two specimens of which have been found in Central Kansas, and the free-tailed bat, found in the north-eastern part of the State. Both are Southern species and their occurrence in Kansas is a matter of some surprise. It has also added to the State fauna the Georgian bat, and is able to record, through the favor of Professor Snow, the little shrew, *Blarina parvula*, from Western Kansas. It would call attention also to the long lost black-footed ferret, or prairie dog-hunter, of Western Kansas, whose rediscovery was recorded a few years since by Dr. Coues, and would urge our collectors and hunters to keep vigilant watch for it with a view to ascertaining its distribution and abundance in the State. Does the distribution of this ferret coincide with that of the prairie-dog? The survey is also gathering statistics with a view to determining the exact distribution of the prairie-dog in Kansas, and its relations to civilization and agriculture. Is the prairie-dog favorable or adversely affected by the advance of civilization upon him? Have the "deserted towns" of this animal become such owing to a desire to shun observation and molestation by man, or were the migrations which they record induced by desire for better forage grounds, or by other causes? Items of information tending to shed light upon the distribution, increase, or extermination, habits, and economic relations of this and other species of the animals of Kansas are greatly desired. For some of our species the historical material must be gathered at once, or it will never be fully known. With birds, as already intimated, the survey is not concerned.

In reptiles, perhaps the most interesting discovery is that of a second species of green snake, the slender green snake, *Cyclophis æstivus*, an austroriparian species, collected by Colonel N. S. Goss, at Neosho falls. Kansas is doubtless the northern limit of this bright-hued, active Southern serpent.

Of fishes the survey has made considerable collections, mainly of smaller forms. Three species new to science have already been described in its reports, and the pretty little zebra-fish of the Rio Grande river, known until recently by Girard's imperfect description only, has been re-discovered and fully described from material sent from Ellis, Kansas, by Dr. L. Watson. The zebra-fish has since proved to be one of the commonest fishes of Western Kansas, scores having been taken from a little stream near Garden City by the writer in two days' collecting last August. The lamprey eel of Kansas, parasitic on the buffalo-fish, etc., proves to

be usually the *chestnut* lamprey, and the material collected tends to confirm the suspicion expressed by Jordan and Gilbert in their "Synopsis of Fishes of North America" that this and the silvery lamprey may be only varieties of one and the same species.

— At a late meeting of the Royal Microscopical Society, Dr. Maddox read a paper, "An experiment on feeding some insects with a 'comma' bacillus, and also with another bacillus (*Bact. subtilis*)," illustrating the subject by preparations exhibited under the microscope.

Mr. Cheshire said that he must, in the first place, congratulate Dr. Maddox on the time he had been able to keep his bees alive in a state of isolation. They were not at all easy to keep so under ordinary circumstances. He had tried himself some similar experiments, and thought he had succeeded in infecting *Musca vomitoria;* but it might be well to remark that in one hive bee he had found eight or ten distinct kinds of bacilli, one of which had a distinct curvature. Amongst bee-keepers there used to be an idea that the bees had no diseases, although there was one affecting the larvæ, but directly a careful examination of the bees was made it was found that they were subject to a great many. One kind had the curious effect of causing all the hairs to fall out, and on examining bees which were so affected he found them all to contain large numbers of the short red bacillus. If any one intended to experiment in these matters it might be useful to know that if the bees were fed with food stained with aniline dyes very curious effects were produced upon the internal organs. Differentiation took place within the body, and when they came to dissect them afterwards they would find it a very great help.

— Among the new investigations started in the Department of Agriculture, not the least important is one relating to economic ornithology. This work has been begun as a branch of that of the Division of Entomology, of which Professor C. V. Riley has charge. Dr. C. Hart Merriam, a well-known ornithologist, and secretary of the American Ornithologists' Union, has been appointed a special agent to take charge of this part of the divisional work. Dr. Merriam will make his headquarters at Sing Sing, New York, until October 1st, and after that at Washington.

The scope of the investigation will cover the entire field of the inter-relation of birds and agriculture, particularly from the entomological standpoint. The inquiry will relate primarily to the *food-habits* of birds, but will include also the collection of data bearing on the migration and geographical distribution of North American species. In this last inquiry the department hopes to have the coöperation of the American Ornithologists' Union, Dr. Merriam being in charge of the Committee on Migration for said Union.

— An officer of the Italian navy (reports *Nature*) after a course of four months' instruction at the Zoölogical Station at Naples.

was attached to the corvette *Vettor Pisani.* After an absence of five months the first consignment arrived—the product of deep-sea work, of dredging and coast-fishery along the shores of Gibraltar, Brazil, and Montevideo; a second collection still more extensive than the first was made during a voyage from Montevideo to Cape Horn, and among the islands of the Patagonian group. Other collections have been made on the Peruvian coast, the Gallapagos islands, and from Panama; also animals from small pools and rivers in Peru. Those from Peru comprise two complete series of embryonic forms—one of a ray, the other of a toad. The *Vettor Pisani* continued its course from Peru to the Philippine islands and China. The results have been so satisfactory that three other Italian naval officers were received at the station, one of them being afterwards stationed at the mouth of the Red sea, while another is collecting in the Mediterranean.

—Dr. W. J. Lewis draws attention to the importance in legal cases (when it is often inpossible to determine whether certain blood stains are human or animal), of the evidence to be derived from a microscopic study of the hairs or textile fabrics of one sort or another generally found entangled with the blood-stains on a weapon that has been used in a murderous assault. He illustrates the value of such evidence by reference to actual cases, and points out the differences between human and animal hair, and the distinguishing features of hair from those of the more common filaments which may be mistaken for it, such as the finer fibers of jute, linen, silk and cotton. The characteristic distinctions which exist between human and animal hair are briefly indicated under four heads viz: (1) The relative proportions of the cortical and medullary structures; (2) The size, shape and arrangement of the medullary cells; (3) The size, shape and arrangement of the superficial cortical cells; (4) The size and shape of the hair-shaft.—*Journal of the Royal Microscopical Society, June, 1885.*

—The effects of the poison of the cobra de capello have been studied, says *Nature*, by Herr Gnezda. The poison was obtained in India by causing the snakes to bite into snails or mussels wrapped in gutta-percha and filled with water. The watery solution thus obtained was reduced by evaporation. The poison belongs to the class of propeptons. Different vertebrates susceptible to the poison died when the dose of the poison amounted to three mg. per kilogramme animal. The time when death followed a full dose of the poison was very various. Rabbits died after half an hour, pickerels after an hour, frogs later, then cats, and lastly pigeons. Stronger doses hastened death. Dilutions and the introduction of artificial respiration delayed death. The poison affected the nerves, especially the central nervous system, and had hardly any effect on the heart.

— Prof. Robert von Schlagintweit, the eminent ethnographer and geographer, died June 13th, in Giessen, at the age of 52. The name of the deceased is chiefly connected with the journey of scientific investigation made by him in 1854–7, in Central India and the Himalayas, in conjunction with his brothers Hermann and Adolphus. The expedition was fitted out at the expense of the King of Prussia and the British East India Company, and added many important and interesting facts to our knowledge in the domains of geography, meteorology, geology, and ethnology. An account of the journey was published in English under the title of "Results of a Scientific Mission to India and High Asia." Prof. Robert von Schlagintweit also traveled in North America, and wrote several shorter works on his experiences there.

— Mr. Mellard Reade's presidential address to the Liverpool Geological Society has been reprinted in the form of a pamphlet entitled "Denudation of the two Americas." The essay may be regarded as a sequel to the address in which he discussed the effects of chemical denudation as a geological agent. He insists strongly on the importance of applying quantitative methods to the study of geological phenomena. In the present paper he calculates the amount of solid matter removed in river-water from the surface of some of the principal river-basins of America. Mr. Reade thinks that the matter which exists in chemical solution in river-water has more importance as a factor in the reconstruction of the earth than is generally recognized by geologists. —*English Mechanic.*

— Prof. C. V. Riley, entomologist of the United States Department of Agriculture, has published Bulletin No. 8, with 46 pages on the periodical or seventeen-year Cicada, comprising an account of *Cicada septendecim* and its *tredecim*, or thirteen-year race, with a chronology of all broods known. A circular has also been issued by the Division, containing lists of localities where these two races last appeared, and a request for information regarding the appearance of the insect during the past season. Brood XXII of Septendecim appeared in 1868, locally, in the following States: New York, Massachusetts, Vermont, Pennsylvania, Ohio, Indiana, Michigan, Delaware, Maryland, District of Columbia, Virginia, Kentucky, and Georgia.

— The second volume of the Proceedings of the Biological Society of Washington contains the following longer articles: The principles of zoögeography, by Theo. Gill; Certain phases in the geological history of the North American continent, biographically considered, by C. A. White; Notes on North American Psyllidæ, by C. V. Riley; remarks on the bag worm (*Thyridopteryx ephemeræformis*), by C. V. Riley, with ichthyological and ornithological articles by Messrs. Goode, Bean, Dresel, Stejneger and Ridgway; while Mr. W. H. Dall describes some Hydrocor-

allinæ from Alaska and California, and Mr. Lester F. Ward enumerates the plants added to the flora of Washington, from April 1, 1882, to April 1, 1884.

—It will be remembered that the Legislature of New York made an appropriation of $18,000 for a course of free public instruction at the museum in human and comparative anatomy, physiology and zoölogy, etc. The course having already proved successful, funds have been promised, as we understand, to enlarge the museum by the addition of the rotunda planned in the original designs for the entire building, by which a lecture hall capable of seating 1200 persons may be built, with other rooms for the display of collections. The museum authorities have greatly strengthened the scientific corps by the appointment of Mr. J. A. Allen, the eminent ornithologist, as an assistant in the museum.

— Volume VI of the Monographs of the United States Geological Survey is devoted to Professor W.M. Fontaine's contributions to the knowledge of the older Mesozoic flora of Virginia, bearing date of 1883, but only recently distributed. The work is based upon the results of several years' diligent search in the older Mesozoic strata of Virginia. It comprises 144 pages of description, and is illustrated with fifty-four plates, some of them reprints of Emmons' figures of Mesozoic plants from North Carolina.

— A new method of collecting rhizopods has been practiced by Professor H. Blanc, who obtained material from the deep water of Lake Geneva by lowering to the bottom a large St. Andrew's cross, to the four extremities of which are attached pieces of very thick glass. After three or four weeks this is raised to the surface again, and the fine mud that has collected on the pieces of glass removed with a brush.

— A new gutta-percha plant has been brought to the notice of the French Academy (*Nature*, May 21), by E. Heckel, who suggests that as a substitute for the *Isonandra gutta* Hooker, which is threatening to disappear, *Butyrospyrum parkii* Kotschy, be used, which possesses similar properties, and which is widely diffused throughout equatorial Africa, between Upper Senegal and the Nile basin.

— A new genus of fleas described by W. Schimkewitsch, under the name of *Vermipsylla alakurt*, has been found to infest cattle in Turkestan, producing great debilitation, or even death. It was observed in the greatest abundance during severe frosts. Originally it is nearly black, but when distended becomes white, with variegated bands (*Zoöl. Anzeiger*, VIII, p. 75).

— At the May 5th meeting of the London Zoölogical Society, Mr. J. Bland Sutton read a paper on hypertrophy and its value in evolution, in which he attempted to show that material changes

in structure might be the result of what was originally a pathological condition.

— At the same meeting Mr. E. T. Newton read a paper on the remains of a gigantic bird (*Gastornis plasseni*) from the English Lower Eocene. The author observed, reports *Nature*, that these fossils proved that in early Eocene times England was inhabited by a race of birds which equaled in their proportions some of the more massive forms of the New Zealand moas.

— Hon. J. D. Cox publishes in the Journal of the Royal Microscopical Society for June an interesting article on the structure of the diatom shell, in which he attempts to prove the actual presence of films of silex, whose tenuity is so great that they are not visible by ordinary transmitted light.

— The Des Moines Academy of Science has issued the first number of its Bulletin, which contains, besides an introductory note, an article by R. E. Call, entitled a geographic catalogue of the Unionidæ of the Mississippi valley.

— Professor J. H. Whiteside, the æronaut, has presented to Woodward's Gardens a canary twenty-two years old. The bird is sightless, songless and very feeble.

— We learn that Dr. Taschenberg, of Halle, is preparing a new edition of the well-known Bibliotheca Zoölogica of Agassiz and others.

— Dr. Franklin B. Hough died June 11th, 1885, aged 62. He was for a while United States Commissioner of Forestry, and gave much attention to that subject.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

PHILADELPHIA ACADEMY OF NATURAL SCIENCES.—April 14.—Dr. H. C. McCook stated that spiders allied to the line weaver, *Theridion tepedariarum*, preserve their activity and spinning habit while exposed to cold ranging from freezing point to zero; that after long and severe exposure they rapidly recover their activity when brought into a warm temperature, and at once resume their habits on the return of spring, even after a severe and prolonged winter. The young of the orb-weavers survive the winter in the admirably arranged cocoons provided by maternal instinct. Early in the spring many nearly full-grown spiders may also be found, all of which have safely weathered the cold months.

A paper entitled "Notes on Mesozoic cockroaches," by S. H. Scudder, was presented for publication.

April 28.—Mr. Morris stated his conviction that the swim-bladder in fishes was a degenerate organ, formerly of use, but now without an important function. The fact that in embryonic states

it is connected with the œsophagus by a duct points to the idea that it formerly performed, to some extent, the function of a lung. The speaker believed that in previous ages fishes visited the land in search of food much more frequently than now, and that an air-breathing apparatus was developed by a pouching of the œsophagus. When the increased number of predatory land animals compelled fishes to confine themselves to water, this structure degenerated.

A paper by Mr. W. S. Blatchley "On the genus Aphredoderus" was presented for publication.

Mr. T. Meehan, in the Botanical Section, remarked on the peculiarities of *Mammillaria haydeni*, and other allied species, the ovaria of which remain buried between the closely appressed walls of the mammæ from April or May until just before the next flowering season, when they stretch out to their full length in a single night. As in this species the fruit is two inches long, and bright red, the effect of its sudden appearance, which is certainly due to elastic projection and not to growth, is very striking.

May 5.—Mr. Willcox stated that Florida sea-urchins were covered in March with shells, some of which contained living mollusks. In January they were free from this covering. *Fulgur perversus* is embedded in the sand when spawning, and attaches the smaller end of the egg-string, first protruded, to a stone below her. When the entire string is liberated the portion last protruded floats out with the tide. As only four or five capsules are to be found in the mollusks at one time, the process of laying the string probably occupies weeks. The speaker stated that he had found specimens only three and a half inches long in the act of spawning.

Professor Heilprin exhibited a pebble from the yellow gravel near Glassboro', containing *Scolithus linearis*. This, which he believed to be the first instance of the occurrence of the fossil in New Jersey, pointed, as did other Silurian and Devonian fossils collected in the same locality, to the origin of the deposits in the eastern continental border.

Mr. A. F. Gentry presented "A Review of the genus Phrynosoma."

May 12.—Mr. Meehan presented the manuscript diary of Wm. Bartram from 1802 to 1822. The migration of birds, dates of blooming of spring flowers, etc., are carefully noted.

Professor Lewis exhibited specimens of fossil plants from the new tunnel at Phœnixville. Some minute phyllopods were also described. The same beds were found in abundance in certain beds at Gwynedd.

Professor Lewis also exhibited specimens of erythrite from Phœnixville, and of cuprite from Frankfort. The former has never before been found in North America, and the latter is new to the locality.

Professor Heilprin called attention to the grouping, by Professor Eugene Smith, of the phosphate beds discovered by the latter, with the Jackson and Vicksburg deposits, as Oligocene. The palæontological character of the beds was given, and the conclusion drawn that there was a strong line of demarkation between them.

"A review of the genera and species of Mullidæ," by E. A. Hall and T. Z. McCaughan, was presented for publication.

May 19.—Professor Lewis announced the discovery of genthite in the Lafayette soapstone quarry. It occurs in small, bright, emerald-green crusts, showing the stalactitic structure characteristic of the species. This discovery proves the presence of nickel in the Pennsylvania serpentines.

Mr. Jos. Willcox stated that genthite had also been found at Webster, N. C.

Dr. Leidy described a number of tape-worms of a new species from a trout. The specimens were mature, measured from three to eight inches in length, and contained eggs in the segments near the head. The name *Bothriocephalus cestus* was proposed for it.

Mr. Potts stated that he had found a digestive cavity in the hydroid without tentacles previously described by him, and had seen it capture and swallow its food. The name *Microhydra ryderi* was given to it; genus and species both new.

Miss Fielde stated that, as a high authority upon nerve tissue had suggested that its reproduction in the earth-worms she had experimented upon was simulated, and that such reproduction was impossible, she had carefully examined the specimens, and found the tissue to be real, and as sensitive as the primitive growth. All the life processes were now performed as completely by the worms which had been decapitated as by those which had not been injured.

May 26.—Professor H. C. Lewis gave the result of his studies of the extreme southern edge of the ice-sheet in Pennsylvania. Certain short ridges of stratified drift, which often seemed to represent a backward drainage of the melting edge of the glacier, were spoken of as marginal kames. The speaker then described kames, eskers or osars, as studied in various parts of the world, and discussed the various theories of their origin. The kames are of gravel, fine within, often coarse without, and boulders and till often lie upon them. They contain no shells, and their courses coincide with the general drainage of the country. These kames seemed to be due to sub-glacial streams draining the edge of the ice-sheet. When the terminal moraine rested against an upward slope this drainage was backward or into the ice.

June 2.—Mr. W. N. Lockington gave an account of the progress of European colonization in Africa, and the opposition to it likely to be presented by the spread of Islamism.

Mr. Potts called attention to a curious fresh-water sponge which

occurs in the dry bottom lands of the Colorado, hanging from branches of trees in districts which are flooded about six weeks in the year. The species had previously only been found in the rock cisterns of Bombay. It is *Mayenia plumosa* Carter.

CINCINNATI SOCIETY OF NATURAL HISTORY.—July 7.—The following papers were read: "On a supposed fossil fungus from the coal measures," and "Obscure markings on rocks of Cincinnati group," by Professor Jos. F. James; "Notes on Tertiary of Alabama and Mississippi, with descriptions of new species," and "Notes on rare or little known Tertiary fossils," by T. H. Aldrich.

THE AMERICAN FISHERIES SOCIETY.—American Fish-Culture Association, order of exercises, Tuesday, May 5th, 1885: 1. Opening address, Hon. Theo. Lyman, president of the society; 2. Appointment of committees and other business. Recess. List of papers: 1. The giant clams of Puget sound, Professor R. E. C. Stearns; 2. Hibernation of the black bass, James A. Henshall, M.D.; 3. Smelt hatching, Fred. Mather; 4. The porpoise fishery of Cape Hatteras, Frederick W. True.

Wednesday, May 6.—5. Results of artificial propagation and planting of white fish in the great lakes, Frank N. Clark; 6. Does transplanting affect the food or game qualities of certain fishes? A. Nelson Cheney; 7. How to restore our trout streams, J. S. Van Cleef; 8. Exhibition of complete series of salmon and trout of North America, Tarleton H. Bean; 9. Objective points in fish culture, M. McDonald; 10. A glance at Billingsgate, W. V. Cox; 11. Work at Cold Spring harbor, Fred. Mather; 12. Oyster Beds of New York, Eugene G. Blackford; 13. On some of the protective contrivances developed by and in connection with the ova of various species of fishes, John A. Ryder; 14. The use of the throwing-stick by Eskimo in fishing, O. T. Mason; 15. The chief characteristics of North America fish fauna, Theodore Gill; 16. Suggestions as to the development of oyster culture in the Chesapeake area, M. McDonald; 17. Biennial spawning of salmon, Charles G. Atkins.

APPALACHIAN MOUNTAIN CLUB, April 8.—Mr. W. M. Davis presented a paper on geographic evolution, illustrated by models; Mr. Frederic Gardiner, Jr., gave an account of a horseback trip in Northern Arizona with lantern illustrations of scenery on the Navajo reservation and on Walnut cañon and the Grand cañon of the Colorado.

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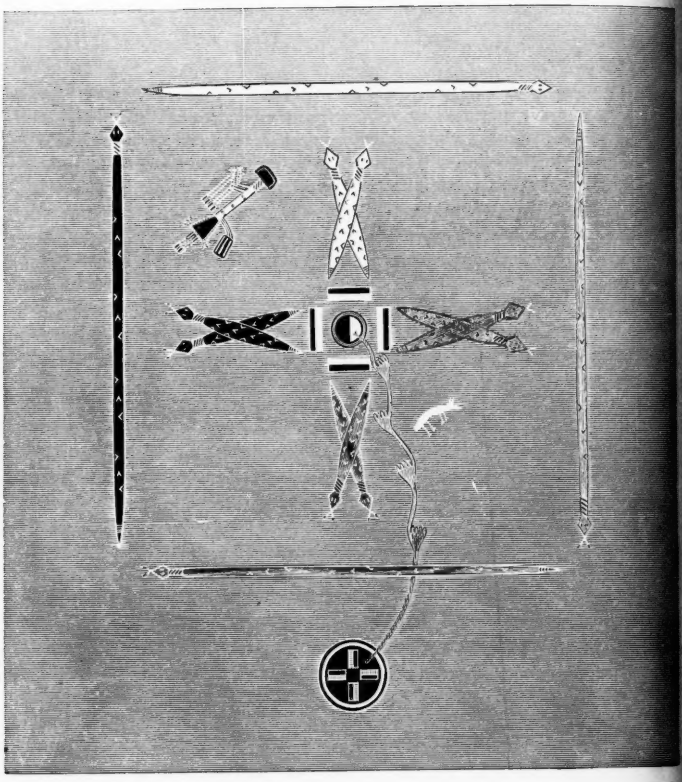
Miami University.

PLATE XXXII.



NORTH.

Navajo Dry-paintings. The visit of the Prophet to the House of the Serpents.